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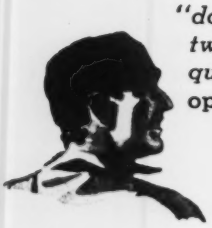

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Good Will Toward Men

THROUGHOUT THE AGES men of every race and creed have set up and worshipped their gods of good will. Born into a world of natural terrors, the earliest men sought in fellowship a refuge from their common fears. From this crude instinct of mutual dependence have been refined the virtues that we know as forbearance, good will and friendship.

Today man has all but conquered his dread of the natural world. The powers that terrified his infancy he has harnessed to his service. Here and there a few dark corners linger to frighten him. Now and then rampant nature spurns his yoke and mocks his mastery. But the old terrors have been laid.

But through his very conquest, man has raised up new dreads. No longer afraid of his world, he now fears his fellow-men. Under that fear he suffers himself to be herded, singly, by class and by nation, into the dismal sloughs of intolerance, suspicion and distrust. New terrors have possessed him.

Never has man needed more desperately those virtues of mutual dependence which, in his arrogance, he feels he has outgrown. Never has his progress, yes, even his survival, been more dependent on his practical fidelity to the spirit of the first Christmas: On Earth Peace, Good Will toward Men. By that spirit alone can man conquer his new terrors.

And in that spirit we lay aside for this issue all matters of routine and material interest, so that we may offer to each reader in whatever clime and of whatever race or creed, the human fellowship of our staff, together with their bountiful wishes for all the well-being and happiness that is implicit in the greeting

★ MERRY CHRISTMAS ★

Willard Chevalier

ENGINEERING NEWS-RECORD

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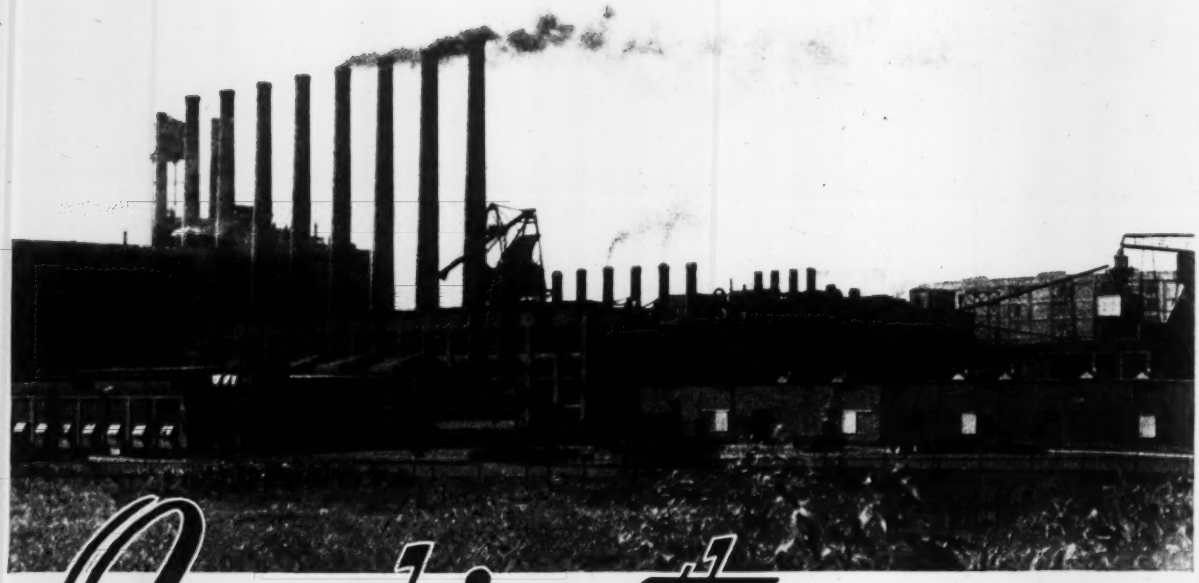

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VOL. 119 *DECEMBER 16, 1937* No. 25

THIS WEEK AND NEXT

MORE THAN FIVE YEARS AGO Engineering News-Record *urged a large emergency program of public works to put people back to work and start recovery from the depression. Since then the question of how much construction has to do with depression and booms has been a controversial one. Opinions are sharply divided. William Stanley Parker throws light on the question.*

Gothic architecture is used to good advantage to house the Cedar Rapids, Iowa, water treatment plant—a plant which provides a generous quantity of good water at rates which are among the lowest in the Midwest.

In the third and last of his series on Wayne County, Mich., roads, Leroy C. Smith describes road design, upkeep, marking and signaling, all of which have one purpose, safety.

Discussions of the probable effect of the President's proposal to bring federal road aid to "normal" have resulted in much confusion. On page 984, inspection of the record focuses attention on the future program.

Flood control of the lower Colorado, effected by Boulder and Parker Dams, has made possible a low-cost low level crossing of the river at Parker, Ariz. Alternate suspended and cantilevered deck spans, and armored steel pile bents are among features of the bridge described in this issue.

Pennsylvania is leading the way in forecasting flood peaks at important points by use of an extensive system of gaging stations and automatic communications.

Several of the papers given at the recent Highway Research Board meeting in Washington are presented in brief abstract form on page 991.

NEXT WEEK—a description of the new Middletown, Conn., sewage disposal plant and enlarged sewerage system.

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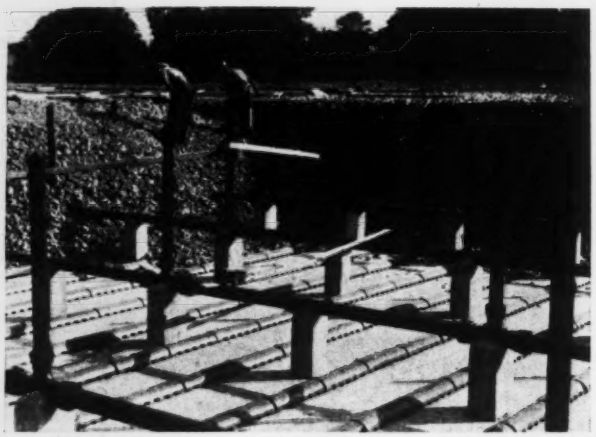
THE COVER PICTURE is an aerial view of foundation work on one of the suspension towers of the Bronx-Whitestone Bridge across the East River above the Triboro Bridge in Greater New York.

Rudy Arnold Air Photo

Number of copies of this issue printed: 31,524

ROBINSON Filter Underdrains



Typical installation of Robinson Filter Underdrains

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at the

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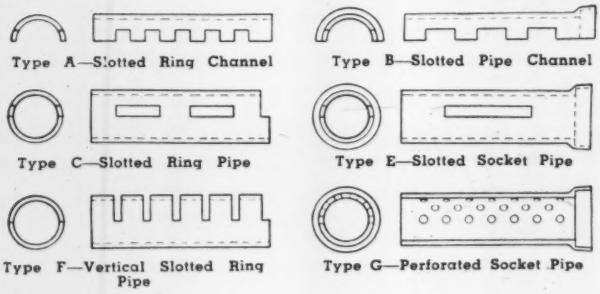
Type A—Slotted Ring Channel
Type B—Slotted Pipe Channel
Type C—Slotted Ring Pipe
Type E—Slotted Socket Pipe
Type F—Vertical Slotted Ring Pipe
Type G—Perforated Socket Pipe

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THE WEEK'S EVENTS

Tentative Allotments For Housing

Straus indicates how much cities can expect for low cost housing under Wagner Act

Although no local housing authority has yet advanced a definite guarantee of its 10 per cent contribution to a slum-clearance project, Administrator Nathan Straus of the U. S. Housing Authority is making tentative allotments of federal funds. He has already promised $71,600,000 to 18 cities which have presented a "reasonable, workable and probable" plan for raising their respective contributions. Additional allotments will be made as fast as the new federal agency can make preliminary studies of the plans offered, and it is expected that they will be continued to an aggregate sum approaching $300,000,000—all the U.S.H.A. has to spend for the first 18 months of its existence.

Announcing the first allotments, Administrator Straus emphasized that they are not based upon the approval of specific plans for definite projects, and that they are therefore subject to revision. Their purpose is primarily to give each authority a definite mark to aim for in preparing plans for actual construction, and in raising local funds.

The next step in the program is the preparation, by each local authority, of definite plans, which will be submitted to Washington for final checking before President Roosevelt approves the final allotment of federal money.

Tentative earmarkings have already been made as follows:

Pittsburgh, Penna.	$10,000,000
Bridgeport, Conn.	3,600,000
Syracuse, N. Y.	2,500,000
Jacksonville, Fla.	1,000,000
Columbus, Ohio	1,500,000
Detroit, Mich.	10,000,000
East St. Louis, Ill.	1,500,000
Annapolis, Md.	400,000
Birmingham, Ala.	4,500,000
Buffalo, N. Y.	4,900,000
Lowell, Mass.	2,700,000
Memphis, Tenn.	1,000,000
New Orleans, La.	7,200,000
Omaha, Neb.	2,100,000
Philadelphia, Penna.	12,000,000
St. Petersburg, Fla.	900,000
Yonkers, N. Y.	2,200,000
Youngstown, Ohio	3,600,000

PWA project rents

In regard to the housing projects now approaching completion which he "inherited" from PWA, Mr. Straus indicates that it is unlikely that the rentals, which he is directed to fix so as to fall within the range that slum-dwellers can afford to pay, will return enough to amortize the loans made by the government. Estimating the rent per room at from $5 to $6.50, it is calculated that the returns will be only enough to pay costs of operation, maintenance, and repairs.

House Group Opposes Road Fund Cut

Representative W. Cartwright, chairman of the House roads committee, announced Dec. 10, according to the New York *Times*, that he would not call his committee together during the special session to carry out President Roosevelt's recommendation for a reduction in federal-aid highway funds.

Congressional action must be taken before Jan. 1 if the President's recommendation that the 1939 road authorization be cancelled, is to be carried out. Allotments to the states of the money are made at that time by the Secretary of Agriculture.

Mr. Cartwright is further said to have declared that at the regular session of Congress next year he would ask his committee to consider a bill extending the Hayden-Cartwright authorization of last year through the fiscal years 1940 and 1941.

Merritt Parkway Opening Put Off Until Summer

The Merritt Parkway in Connecticut will not be officially opened until summer, it has been decided. State Highway Commissioner Macdonald reached this decision after an inspection trip over the completed portion between Norwalk, Conn. and the New York state line.

At present the ramps leading from the side roads are still unpaved, as is also a 2½-mi. section just south of Stamford. Further paving has been abandoned for the winter because of freezing weather.

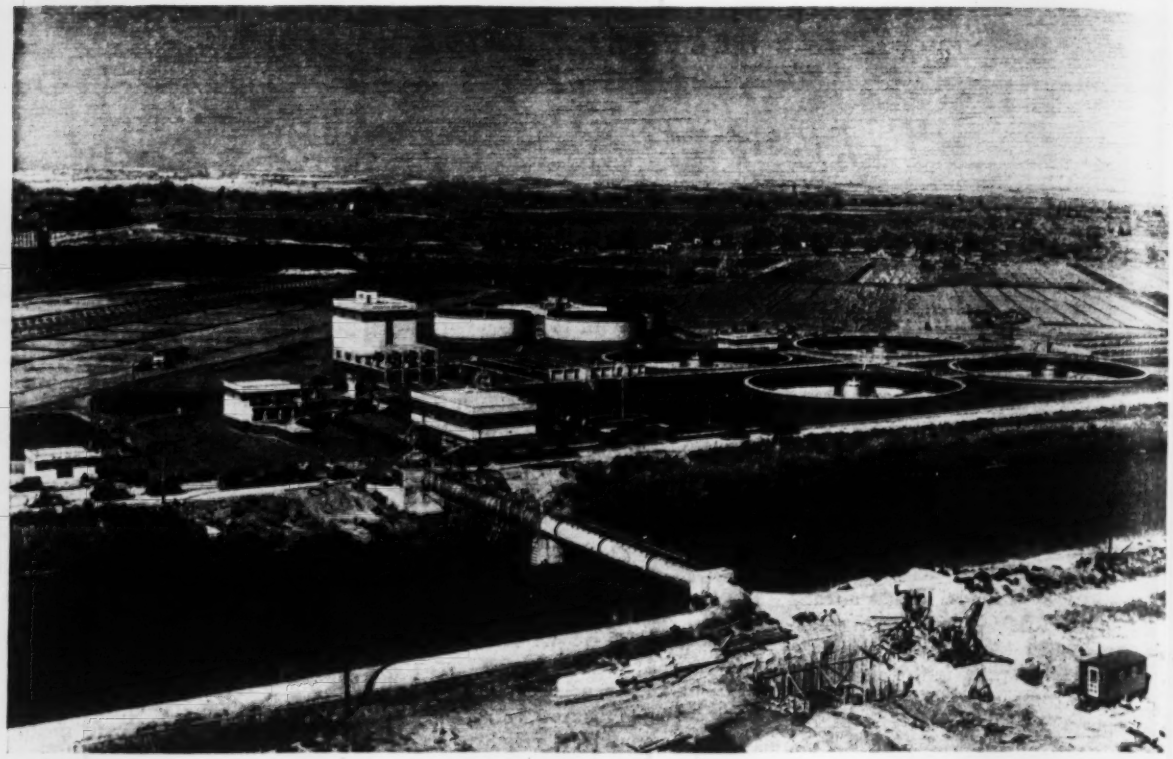
Two Bids Offered On Coulee Dam

M.W.A.K. and Six Companies, Inc. are low with a joint bid of $34,000,000

Two proposals with a spread of 25 per cent were submitted for the completion of the high dam at Grand Coulee at the opening held by the U. S. Bureau of Reclamation at Spokane, Wash., on Dec. 10. The Interior Construction Co., a combination of the Mason-Walsh-Atkinson-Kier Co., present contractors on the low dam, and the old Six Companies Inc. group, builders of Boulder Dam, submitted the low bid of $34,442,240. A group of western contractors under the name of Pacific Constructors, Inc., submitted the second and only other bid, $42,185,802. These bid prices do not represent the entire cost of the work, for the government furnishes all cement, steel, piping, machinery, etc. entering into the permanent works. The contractor supplies all temporary construction materials and all concrete aggregates, available at a nearby gravel pit owned by the government.

The firms comprising the Interior Construction Co. include: Silas Mason Co., New York City; Walsh Const. Co., Davenport, Ia.; Guy F. Atkinson Co., San Francisco; W. E. Kier Co., San Diego; Morrison-Knudsen Co., Boise, Idaho; J. F. Shea Co., San Francisco; MacDonald & Kahn Co., San Francisco; Pacific Bridge Co., San Francisco; Henry J. Kaiser Co., Oakland, Cal.; Utah Const. Co., Ogden, Utah; General Const. Co., Seattle. Thomas Walsh is named as chairman of the board of the combination, Henry J. Kaiser is listed as president, and Guy F. Atkinson and Charles Shea as vice-presidents.

The following firms were listed as making up the combination of Pacific Constructors, Inc.: S. M. Griffith Co., Los Angeles, Lawler & McGuire, Butte, Mont.; Shofner, Gordon & Hinman, Denver; Metropolitan Const. Co., Los Angeles; Dave W. Thurston, Pasadena, Cal.; American Concrete & Steel Pipe Co., Los Angeles; Hunkin & Conkey, Cleveland, Ohio; and L. E. Dixon Co., Los Angeles.



NEW SEWAGE PLANT FOR DENVER

A NEW SEWAGE DISPOSAL PLANT was placed in operation at Denver, Colo., Nov. 29. It will treat the entire flow of sanitary sewage and industrial wastes from the city of Denver and Denver county. Design of the 54-m.g.d. plant was described in *Engineering News-Record* in the issue of Oct. 15, 1936.

Unusual flexibility was provided in the design of the plant so that any degree of treatment from plain sedimentation to complete treatment may be given. The degree of treatment will vary with the amount of water available for dilution in the Platte River. This water supply will be increased by completion of the Williams Fork transmountain diversion, considerably reducing the cost of operation of the plant.

Black & Veatch of Kansas City, Mo., were designing engineers on the project.

Fort Supply Plan Rejected By Oklahoma City Voters

Voters of Oklahoma City at a bond election Dec. 7 defeated a proposal to issue $2,357,000 of bonds to meet the city's share of the cost of the proposed flood control and water supply Fort Supply project. Although a majority of voters favored the bond issue, it failed to receive the 60 per cent majority required. The showing made was so favorable that sponsors of the project made plans for an immediate re-submission of the proposal to the voters.

The Fort Supply Dam on Wolf Creek, a tributary of the North Canadian River about 135 miles northwest of Oklahoma City, will be an earth dam with an uncontrolled concrete spillway and a regulating discharge conduit. It will be about two miles long with a maximum height of 82 ft.

Under the proposed plan of joint federal-city construction, 100,000 acre-ft. of the 202,000-acre-ft. capacity of the reservoir would be available for water supply storage and would be released on demand by the city into the North Canadian River channel to replenish the municipal reservoir.

Of the $7,000,000 total cost of the project, $5,000,000 would be provided by the federal government and about $2,000,000, the cost of the extra storage provided, would have been provided by the city if the bond issue had been approved.

When President Roosevelt last month ordered a general shutdown of large federal flood control projects, an exception was made in the case of the Fort Supply project because of its connection with the Oklahoma City water supply (*ENR*, Nov. 18, 1937, p. 806).

• • •

N. J. Bridge Approved By War Department

The War Department has given its approval to the construction of a high level lift bridge across the Passaic River between Newark and Kearny on the Lincoln highway. The new bridge, with a vertical clearance of 40 ft. at high tide will replace an existing lift bridge with a clearance of only 11 ft.

Increased Amount Alloted For Possum Kingdom

President Roosevelt has approved allocation of $4,500,000 of WPA funds for construction of the Possum Kingdom dam on the Brazos River about 18 miles from Mineral Wells, Texas. Under a new arrangement the dam is to be built by the Brazos River Reclamation District with its own engineering staff; the U. S. Engineers, who were originally assigned by WPA to build the dam, have stepped out of the project.

The present allotment marks an increase of $1,400,000 over the original estimate of cost. When the dam was first proposed, the Brazos District estimated its cost at $3,100,000, and this amount was allotted by the WPA, with the provision that construction be supervised by the Corps of Engineers. Further investigation by the Army indicated foundation difficulties, and an increase in the allotment to $6,600,000 was requested. The need for this additional increase was disputed by local interests.

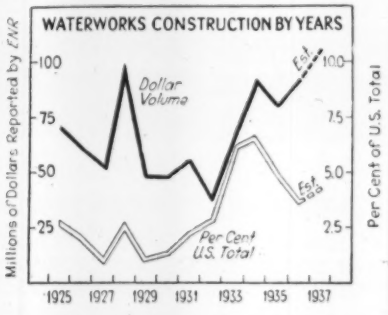
THE CURRENT TREND

This week's news of contract volume and construction cost factors

Waterworks Break Record

Middle Atlantic states contribute 61 per cent of 1937 total. New York's water supply program responsible

Waterworks construction volume, $100,275,000 for the 49 weeks of 1937, exceeds all yearly totals recorded by *Engineering News-Record*. This new

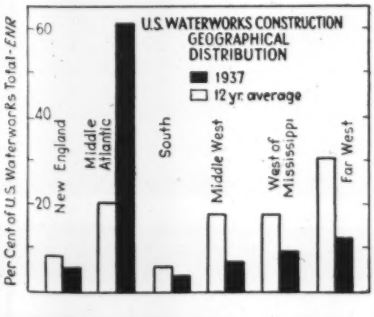


high and the former record of $99,635,000 in 1928, are due largely to waterworks awards in the Middle Atlantic states. The lowest annual volume since 1925 is $34,586,000, recorded in 1932. Since 1932 waterworks volume has exceeded $67,000,000 every year and $92,000,000 in 3 years. The average volume for the 12 years preceding 1937 is $67,061,000.

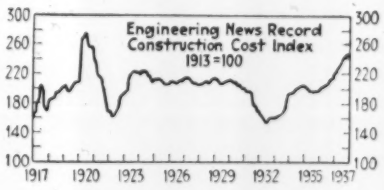
Waterworks construction awards for the 11 months of 1937 are 4.3 per cent of the total engineering awards reported by *ENR*. From 1925 to 1930, waterworks construction ranges from 1.2 to 2.8 per cent of the U. S. construction total. From 1931 to 1936 it ranges from 2.3 to 6.7 per cent of the total.

During the 11 months of 1937 the Middle Atlantic states account for 61.3 per cent of the waterworks total. New York City's Delaware Aqueduct contracts are responsible for the large volume in this section. Far West accounts for 12.5 per cent of the 1937 waterworks; West of Mississippi, 9.7 per cent; Middle West, 7.0 per cent; New England, 5.3 per cent; and South, 4.1 per cent.

In the 12 years preceding 1937, Far West averages 30.5 per cent of the yearly waterworks construction volume. Los Angeles Metropolitan Water District program from 1933 to 1936 was instrumental in establishing this high average for the Pacific Coast states. For the same period, Middle Atlantic averages 20.5 per cent; Middle West and West of Mississippi, 17.6 per cent; New England, 7.8 per cent; and South, 6.1 per cent.



Construction Cost Index Levels Off



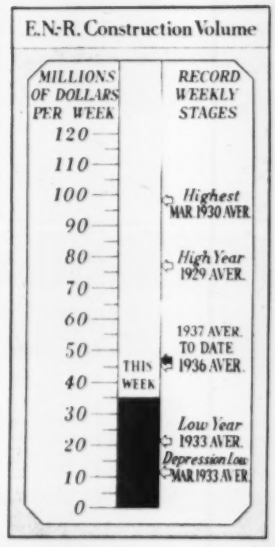
Engineering News-Record Construction Cost Index has remained practically stationary for three months. This levelling off is due to the stabilization of the common labor wage average. Common labor is entirely responsible for the increases reported in the *ENR* Construction Cost Index for the latter half of 1937. The index average for 1937 is 236.41, 15 per cent above 1936. This is the second highest cost year on record, but 6 per cent below 1920, when 251.28 was the average of a year that saw a top of 273.80.

Business Briefs

PORTLAND CEMENT PRODUCTION totals 11,374,000 barrels for October; shipments 11,190,000 barrels; and stocks at the end of the month, 21,572,000 barrels. Production is 8.8 per cent and shipments 14.5 per cent lower than a year ago, while stocks are 19.3 per cent higher, as reported by the U. S. Bureau of Mines. Ratio of production to capacity is 52.0 per cent for October, compared with 53.1 per cent for September, and 56.0 per cent for October, 1936.

CONCRETE PAVEMENT YARDAGE awards for November are 16 per cent lower than November 1936, the Portland Cement Association reports. Road yardage is 9 per cent lower, and streets are 33 per cent lower than last November. Alleys are 102 per cent above November 1936. Reported totals are:

	Square Yards Awarded		
	November 1937	11 mo. 1937	11 mo. 1936
Roads	2,319,836	37,366,949	36,607,457
Streets	789,458	12,259,273	14,566,437
Alleys	60,828	529,826	344,503
Total	3,170,122	50,156,048	51,518,397



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Dec. 17 1936	Dec. 9 1937	Dec. 16 1937
Federal	$1,466	$5,289	$2,585
State & Municipal	15,620	17,853	26,008
Total public	$17,086	$23,142	$28,593
Total private	22,767	8,731	7,113
TOTALS	$39,853	$31,873	$35,706

Cumulative
1937 (50 weeks) $2,347,849
1936 (51 weeks) $2,293,969

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1936 51 Wks.	1937 50 Wks.
NON-FEDERAL	$920,501	$1,414,203
State & mun. bonds	495,498	492,508
Corporate securities	244,278	513,630
PWA loans, grants	164,727	178,126
RFC loans	24,998	29,939
Fed. aid for highways	.....	200,000
FEDERAL	$691,237	$746,223
TOTAL CAPITAL	$1,620,738	$2,160,426

ENR INDEX VALUES

Index Base	1913	1926
Construction Cost (Dec.)	244.95	117.75
Construction Volume (Nov.)	146	64

New Parkways Proposed

New York City urged to acquire $8,000,000 worth of rights-of-way for parkway network in three boroughs.

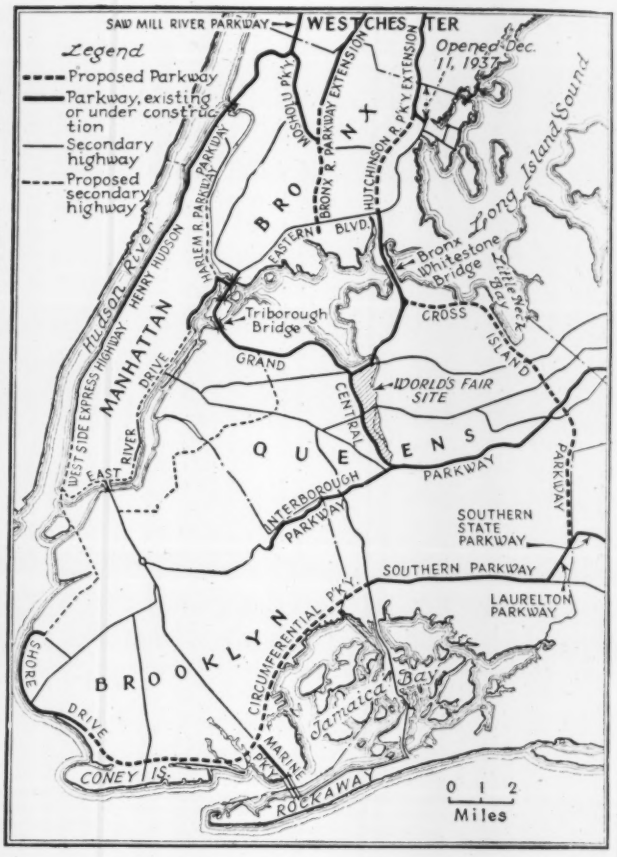
IN A REPORT to the mayor and board of estimate of New York City, Dec. 7, Robert Moses, commissioner of parks, urged the purchase of rights-of-way (assessed value $8,026,182), to extend the network of parkways among the three boroughs of Brooklyn, the Bronx and Queens, at the same time providing connections with the extensive parkways of Westchester County and Long Island. Three of the four principal routes proposed have a close relation to the Bronx-Whitestone Bridge. Commissioner Moses emphasizes that immediate acquisition of the land is necessary if advantage is to be taken of present values and of the open country in which most of it is now located.

The new routes are as follows:

In the Bronx: (1) An extension of Bronx Parkway south along the east side of Bronx Park and thence by way of a new direct route to Eastern Boulevard; (2) An extension of Hutchinson River Parkway south to the Bronx-Whitestone Bridge approach at Eastern Boulevard. A part of this extension, in Pelham Bay Park, was opened to the public on December 11.

In Queens: A Cross Island Parkway beginning at the Bronx-Whitestone Bridge and extending east and south along Little Neck Bay and thence south to Laurelton Parkway.

In Brooklyn: An extension of the Circumferential Parkway eastward from the recently completed Shore Drive around to a connection with the Marine Parkway and thence, skirting Jamaica Bay, to a connection with Southern Parkway.



CITY PARKWAY NETWORK GROWS

Water Manager Resigns After Forty Years

George H. Fenkell, general manager of the Detroit Board of Water Commissioners, resigned that post Dec. 6 after 44 years' service in the water department, for 20 of which he served as general manager. Although Mr. Fenkell is relinquishing his duties as general manager, he will be retained by the board in an advisory capacity with the newly created title of consulting engineer.

L. G. Lenhardt, now commissioner of public works of the city, is to succeed Mr. Fenkell. However, until July 1, when Mr. Fenkell becomes eligible for a pension, Mr. Lenhardt will fill the position of assistant engineer of water system construction. It is expected that in July, when he has familiarized himself with the duties of the position, he will be appointed to the position of superintendent, general manager and chief engineer.

Commenting on his retirement, the Board of Water Commissioners said that Mr. Fenkell's "services have been of inestimable value to this department." The commission pointed out that during Mr. Fenkell's service with the department, and largely under his supervision, the water system has added 4,102 miles of pipe and the value of plant has increased from about $5,000,000 to $118,000,000.

Mr. Fenkel is 64 years old. He began his engineering work in 1890 as a rodman for the Akron & Chicago Junction R.R., and later for Ionia County, Mich. After a year at the University of Michigan he became assistant resident engineer for the Wilkes-Barre & Eastern R.R. Eighteen months later, in 1894, he joined the staff of the Detroit board of water commissioners, as a draftsman. After several months with the board, he returned to railroad work for about a year and then returned to the board, at first as draftsman and a few months later as chief draftsman. He again interrupted his service with the board when he served as civil engineer for the commissioners of water works of Erie, Pa. from 1902 to 1908.

He returned to Detroit as civil engineer for the water board and has been connected with the city of Detroit since that time. He was appointed commissioner of public works in 1913, and general manager of the board of water commissioners in 1918.

Broadway Tunnel Opened At Oakland

Governor Merriam of California on Dec. 5 blew open a wall of papier mache blocks sealing the entrance to the Broadway low-level tunnel, opening it to traffic. The twin bore tunnel, 3,168 ft. long, is cut under the Berkeley Hills and effects important savings in distance, elevation and curvature between Oakland, Calif. and the valley beyond the hills. Each bore of the tunnel contains a 22-ft. roadway and a 3-ft. walk.

Considerable difficulty was experienced in the construction of the tunnel. Contract was awarded to Six Companies of California, in 1934, for $3,684,000, and the completion date was set for May, 1936. The contractor ran into ground difficulties, and in 1936, with the tunnel about 70 per cent complete, abandoned the job.

Joint Highway District No. 13, owner of the tunnel, then called for bids on the completion of the tunnel and after the first call had brought forth no bid, awarded the contract on a second call to the George Pollock Co. of Sacramento and R. G. Clifford of San Francisco on their joint bid of $731,000.

Arguments Ended On Power Loans

Decision on PWA loans for municipal power expected early next year

Oral argument was concluded December 8 before the U. S. Supreme Court on cases brought by the Alabama Power Co. and the Duke Power Co. challenging the actions of the PWA in making loans and grants to four municipalities in Alabama and Greenwood County, South Carolina, for construction of publicly-owned electric facilities competing with the companies now serving the areas. The court now has the cases under advisement, and a decision is expected soon after Jan. 1.

The decision will determine the fate of 52 such projects with a total estimated construction cost of $84,026,288, for which PWA has allotted outright grants of $21,674,408 and loans of $30,191,944. All of these are now under injunction preventing the transmission of the PWA money to the municipalities in question.

Acts said unconstitutional

Company attorneys charged that the National Industrial Recovery Act of 1934 and the Emergency Relief Act of 1935 are unconstitutional if construed so as to permit the allocation of money intended for unemployment relief to the construction of competing power facilities primarily intended to drive down electric rates.

PWA Administrator Harold L. Ickes was accused of setting up his own standards for approving loan applications, basing his decisions more upon the existing rate structure in the town than upon relief needs, and withholding such grants if the utility company in the area would agree to a substantial rate reduction. Approval of the allotments would, it was contended, result in the complete destruction of the utilities' investments in all the towns in question.

Competition legal

The government's answer was delivered by Solicitor-General Stanley Reed and Jerome Frank. They argued that, in the first place, the utility companies have no grounds for suit, since the competition of the respective municipalities is admittedly legal. Should it be held, however, that the companies have standing on which to base a suit, the government argues that loans and grants from the relief funds for power-plant construction are legal under the terms of the statutes, and that Congress did not exceed its powers in delegating to Administrator Ickes the authority to decide whether or not an allotment was justified for any particular project which was proposed.

In making a loan, it was pointed out, it is the duty of the administrator to assure himself of the economic stability of the bonds which he is to take, and in this determination a study of the rates by the competing utility is an important factor. If these rates are reduced while the project is under consideration, the action may impair the economic stability of the project to such an extent as to make disapproval necessary. No attempt is made to force any municipality to build a competing project; on the contrary, the application is made by the local authorities and it is they who determine what type of project—bridge, building, power plant, or other improvement—is most needed by their town.

• • •

Plan Last Highway Link To Circle Manhattan

The Board of Estimate of the City of New York on Dec. 10 accepted the plans for a 2½-mi. express highway along the southeast end of the Harlem River. With this action, plans are now complete for an express highway entirely circling the island of Manhattan.

The newly accepted parkway, which can be seen on the map on page 966 as a light dotted line labelled "Harlem River Parkway," will join the existing Harlem River Speedway, shown as a light solid line, to the Triborough Bridge. The drive will be 100-ft. wide, containing sidewalks and two 32-ft. roadways. Commercial activities along the riverfront will be made to conform with the new drive and the drive itself will be screened from commercial activities by a strip of planting. Service streets 30-ft. wide will be provided adjacent to the drive where private property abuts on it.

When present plans are completed, the island of Manhattan will be completely circled. On the northwest, the Henry Hudson Parkway along the Hudson River will join at its southerly end to the West Side express highway, which will eventually go all the way to the Battery and swing around to connect with the East River drive. This will extend from the connection north to the newly approved Harlem River Parkway.

It is planned ultimately to join up the east and west side parkways by means of crosstown tunnels at Canal St., 37th and 38th Sts., and at 57th St. The 37th St. tunnel was approved for immediate construction on the same day by the Board of Estimate when it overruled objections of property owners near the easterly exit.

Commission Halts Utility Merger

Federal Power Commission hold mergers must demonstrate benefits to public

Holding that the Public Utility Holding Company Act of 1935 does not require the merger of utility operating companies in the same territory unless definite benefits to the public will come from the merger, the Federal Power Commission on Dec. 11 denied an application for permission to merge the Inland Power & Light Co. of Oregon and Washington with the Pacific Power & Light Co.

The commission expressed its belief that the holding company act "is not intended to require the merger of two operating companies merely because they operate in the same territory and each supplement the activities of the other. . . .

". . . Consolidation or merger of horizontal operating public utilities is not necessarily a 'simplification of corporate structure' within the meaning of the . . . act. The simplification of corporate structure which is sought to be promoted by that act is the elimination of one or more companies of a vertical structure which operate no facilities and serve no interests of the consumer or the public. . . .

". . . It is not sufficient for an applicant merely to show that no serious harm may be apprehended as a result of the proposed merger or that such merger is a matter of indifference. . . . The burden is upon the applicant to show that the proposal is consistent with the public interest. . . . [The commission must] deny an application for approval of the merger . . . when it cannot be shown . . . that the consuming public will be benefited thereby."

In the case before it, the commission found that no rate reductions or simplification of regulation could be expected from the merger and that the merger was not therefore "consistent with the public interest within the contemplation of the federal power act," and permission was therefore denied.

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Michigan Power Plant Washed Into River

Undermining of the municipal hydroelectric dam at Pawpaw, Mich., caused a washout into which fell the power generator and water wheels Dec. 8. Soundings indicate that they are more than 15 ft. below the original bottom of the river, covered up with sand. The Pawpaw plant is valued at $50,000.

LABOR NOTES

GOVERNOR MARTIN of Oregon is making an attempt to end the critical situation created in Portland by the nation-wide boycott by the American Federation of Labor carpenters union against lumber produced by C.I.O. workmen. The National Labor Relations Board has certified the International Woodworkers of America, C.I.O., as collective bargaining agent in the Portland mills, and the consequent shutdown has heavily burdened relief rolls in Portland. The governor, disregarding the N.L.R.B. certification, is holding elections of his own in the mills. The first election, at the Inman-Poulsen Lumber Co., resulted in a victory for the C.I.O. by a vote of 376 to 183. A.F.L. unions, however, state that they will continue their boycott unless A.F.L. workers are employed in the mill.

DISPUTES between the two labor bodies is causing trouble also in the city of St. Louis, where the Building Trades Council, A.F.L., has objected to the city letting a contract to the low bidder for showcases to be placed in the new Soldiers Memorial building because the low-bidding company employs C.I.O. workers. The low bid for the cases was $13,800; others bids are $14,950, $15,200 and $16,300.

ANOTHER city government affected by building trades demands is Cincinnati. There the International Hodcarriers and Building Laborers Union has protested to the city council against a 50-cent wage rate for common labor on city and relief work proposed to the council by the city manager. The union asserted that they had established a prevailing wage of 75 cents an hour.

A MINIMUM wage scale has been adopted by the Maryland Board of Public Works to be specified in contracts on the new state building project which is to be carried out with the aid of PWA. The scale ranges from 40 cents an hour for common laborers to $1.80 for certain classes of skilled labor.

IN TEXAS, new minimum wages on state highway projects become effective Dec. 17. Rates established as prevailing under the Texas law are 40 cents per hour for common labor, 50 cents per hour for intermediate, and $1 per hour for skilled. The expiring rates were 35 cents, 45 cents, and 75 cents, respectively.

SKILLED labor is not so highly paid in Canada, where a wage rate of 80 cents an hour was established for Ottawa carpenters under an industrial standards act agreement early this month. This rate has been received in the past by union carpenters, but under the new agreement all carpenters must receive it. An 8-hr. day and 44-hr. week are provided for in the agreement, as is a wage increase to 85 cents after May 1.

PROVISION for licensing of journeymen plumbers has been made in an ordinance passed last month by the city council of Buffalo. To obtain a license plumbers must give a statement of their experience and pass an examination. Licensed journeymen plumbers may not compete with their employers on odd jobs, as the ordinance specifies that those who work as journeymen plumbers must be in the employ of another. Provision is made for apprentice plumbers to file a statement of the beginning of their apprenticeship so that evidence of their training may be available when they come to apply for a journeyman's license. Fines of $250 are provided for doing plumbing work without a license.

FIRST TIES LAID ON BAY BRIDGE

THE FIRST TIES for the electric railway system over the San Francisco-Oakland Bay Bridge to be laid on the bridge proper were placed at the east end of the structure Nov. 29. Charles E. Andrew, bridge engineer, officiated, assisted by E. A. Brown, chief engineer of the California Redwood Association, and James Graham, superintendent for the Pacific Bridge Co., the contractor.

A total of 105,000 redwood ties will be used in the electric railway system, of which about 50,000 will be laid on the bridge proper. Ties on the bridge range in length from 9 to 15 ft. and are 8x9 in. in thickness.

The ties are laid from a special traveling platform directly on the stringers. The ties are notched to fit the stringers at a mill constructed on Rinton Hill in San Francisco and are brought onto the bridge with each tie marked for a specific place in the roadbed. The notches vary in depth from ¼ in. to 1¼ in., depending upon the position of the tie in the roadbed. Ties are being laid at the rate of about one a minute on the bridge proper.

Ohio Flood Projects Are Approved

Presidential approval of project allocations has cleared the way for an immediate start on fifteen local flood protection jobs on the Ohio River and one at Middlesboro, Ky., on the Cumberland, with an aggregate estimated cost of $24,877,000. This work will be carried on by force account in order to utilize the largest possible amount of relief labor. An allotment of $5,000,000 from relief funds has been made, which is all that can be spent before the end of the fiscal year next June.

The projects were authorized by a bill approved Aug. 28, 1937, which directed the Chief of Engineers to select a list of urgently-needed projects in the Ohio Valley from the comprehensive plan for flood control in that area submitted to Congress last spring. Factors considered in making the selection included the amount of protection now given the respective localities, the ability of local governments to provide the needed land, and the availability of relief labor.

N. Y. Tunnel Contracts Remain Unsigned

No explanation available for high wage rates stipulated in specifications

Signing of the contracts for the first three sections of tunnel on the Delaware River aqueduct has been delayed by the New York Board of Water Supply, though awards were made to the low bidders shortly after bids were opened on Nov. 9. Although no information is forthcoming as to why the contracts have been held up, or when or what action will be taken, the delay is assumed to be caused by the board's reluctance to proceed under the high wage rates certified to it by the city comptroller as prevailing.

Just why the wage rates stipulated in the specifications were set higher than those prevailing, in fact higher than have ever been paid in the Metropolitan area of New York, still remains a mystery. The board objected to the high rates, and even considered postponing opening of bids, but after consultation with the comptroller's office went ahead with the opening as scheduled and subsequently awarded the three sections for nearly $34,000,000.

Under Art. 8, Sec. 220, of the New York State Labor Law, any public agency within the state contemplating construction work must apply to the fiscal officer of the political subdivision involved for the prevailing rates being paid in the vicinity of the work to be done, and these rates must be stipulated as minimum scales to be paid under the contract. In the case of New York City, the city comptroller is the fiscal officer that determines the rates. Following previous custom in cases where the work lies outside the city limits, the comptroller appealed to the State Department of Labor to ascertain the prevailing wages in Westchester and Putnam Counties, where the tunnel section is located. Under the law the comptroller is not required to seek the aid of the labor department nor to accept its findings; likewise the department is not compelled by law to ascertain prevailing rates for city work. Action is voluntary on both sides.

However, the commissioner of labor furnished the comptroller with a set of rates for the various labor classifications, and these were certified to the Board of Water Supply as prevailing, and thus were incorporated into the contracts. Many of the skilled rates were set at $2.12½; corresponding classifications on New York City subway work run from $1.65 to $1.75 (*ENR*, Nov. 18, 1937, p. 811)

The comptroller has made public his side of a controversy that developed between his office and the labor department prior to opening of bids. Correspondence between the two shows that the labor commissioner, after receiving protests from bidders, suggested that the bids be postponed pending a redetermination, and then almost immediately advised the comptroller that as far as the labor department was concerned the rates as originally determined should stand. The comptroller, in turn, notified the Board of Water Supply to this effect the night before bids were to be opened, and the opening proceeded as scheduled.

In an interview with a representative of *Engineering News-Record*, an assistant commissioner of the labor department refused to reveal how the high rates were determined, other than to intimate they were ascertained from field sources. No hearing was held; none is required by law. The department made no attempt to defend or justify the rates.

It is reported that a New York contractor when compiling his bid personally protested to the Department of Labor and was told that the high rates were demanded by labor leaders of Westchester County who threatened to call a construction strike if their demands were not met.

Temporary Rail Tunnel Planned at Shasta

An early agreement is expected between the Bureau of Reclamation and the railroad line operating through the site of Shasta Dam, major item in the Central Valley project. The agreement is based on a new plan for handling the railroad relocation which is expected to save two years in the time of building the dam.

The relocation plan, announced Dec. 13 by Commissioner of Reclamation Page and R. F. Walter, contemplates driving a temporary railroad tunnel under the west abutment through which trains would operate while the dam was being built. Construction of the dam and of a 37-mi. relocation of the railroad could thus proceed simultaneously.

"It appears likely", Mr. Page said, "that we shall be able to announce soon a contract under which the government will reimburse the railroad for vacating its present right of way in the Sacramento Canyon and the railroad will undertake its own job of building a new line."

Northern California Rivers in Flood

Dam and bridges washed out and buildings destroyed as rivers rise

The most serious flood condition in many years took heavy toll of bridges, railroads, and highways in northern California as rivers there reached flood level over the weekend of Dec. 12 as a result of heavy rains throughout the previous week. Few main highways in northern California remained open to traffic and many towns were completely marooned. Heavy damage was done to frame buildings in the lowlands and several lives were lost.

At Red Bluff the Sacramento River rose 18 in. above the record set in 1909.

Numerous breaks occurred at levees along the Sacramento River. At one point repairs were made with sandbags placed by workmen using sacks dropped from airplanes.

The entire settlement of Butte City was inundated when the Sacramento broke through the levee at three places.

Dam breaks

The Pine Creek reservoir dam above Alturas burst, flooding the streets of the city, washing out a number of residences and buildings, and forcing the city's 3,000 inhabitants to move to higher ground.

At Downieville, debris lodging against a two-year-old concrete highway bridge over a fork of the Yuba River caused undermining of the northern abutement and the loss of one 40-ft. rigid frame span. Many frame buildings were destroyed by backwater from the bridge.

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Traffic Engineering Bureau Planned in Detroit

A traffic engineering bureau headed by a qualified traffic engineer and having three assistant engineers, three clerks and five recorders at an annual personnel cost of $34,000 is in the process of formation in Detroit, Mich. It is a division of the Police Department and is established following recommendations in a report of F. M. Kreml, directing the work of the Accident Prevention Bureau.

Engineering phases of traffic control to come under the new bureau include traffic signs and signals, parking, traffic routes, development of an integrated system of stop-and-go lights and a coordinated system of thoroughfares for large traffic volumes.

News Continued on page 995

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Land Descriptions

Sir: Some more about "Land Descriptions."

Following is the description given me for a tract that I was to survey and establish corners on:

"Beginning at a cabbage in a hammock; thence west 98 chs to Pride of Egypt; thence N. 80 degrees W. to a pine; thence along a public road S. 50 degrees E. to a stake; thence E. 100 chs to Tomoka River; thence along Tomoka River to its mouth; thence along Haulover River to P. O. B."

To explain somewhat: A cabbage is a species of palm of which the heart is edible and resembles cabbage in taste; a hammock is a densely grown, jungle like, somewhat elevated part of land; the Pride of Egypt is also a tree. Only southern people are familiar with these appellations. Will also state that after considerable investigation and study I was able to make a satisfactory survey of above.

Can you beat this?

C. E. GARNETT

Daytona Beach, Fla., November 22, 1937.

Sir: I have been considerably amused and interested by the rather picturesque real estate descriptions coming in from various sources but have not yet seen one that quite matches the following that is taken verbatim from the Town Records of East Parish of Guilford, now the town of Madison, Conn.

"A terrior of land belonging to Nicholas Munger deceased this 30th day of March, Ano: 1670 as followeth:—?his home lott at the Neck containing and allowed for 3 akers more or less fronting upon the highway going into the Neck on the North rearing back to the beach South bounded by the land of Steven Bishop west by the common land East from a parsell of upland lying in the Neck containing thirty-two acres more or less allowed for seaventene running crosse from the Neck river on the North to the Sea on the South past the land of Daniell Benton past the land of Steven Bishop on the east a way being allowed crosse the said lotts as in all the rest of the lotts there."

As Prof. L. E. Conrad of Kansas State College remarked when he read the above, "That proves one thing. We are improving."

H. H. MUNGER

Manhattan, Kansas, November 27, 1937

Painless Square Root

Sir: The average person finds the determination of square root of large numbers a task; either by the conventional method or by the use of seven-place logarithms if interpolation is necessary. The slide rule will give only three terms but can be made to yield three or four additional terms following a simple calculation. In the example given below, set up the number as shown, omitting the decimal point. We know from inspection where it belongs in the root.

(1) By slide rule, find the square root to the first three terms. Square it and subtract from the number and divide the difference by two. Place a decimal point where shown.

(2) By slide rule, divide the quotient just obtained by the partial root, the result being the next succeeding terms.

Example I. Find $\sqrt{805.1286}$

(1) By slide rule, 1st three terms = 28.3

```
  283
  283
 ----
  849
 2264
  566
-------      8051286
80089      —80089
           --------
            2|423.86
              211.93
```

(2) By slide rule, next three terms are:

211.93/283 = .749

Then $\sqrt{805.1286} = 28.3749$

(The correct result is 28.37478+)

In the arithmetical solution of square root, we use a divisor composed of twice the root already found plus the next term. In the examples given above, we have in effect, done the same thing by taking one-half of the remainder, but we have ignored any consideration of the next term. Such consideration may be given by subtracting the square of the next term from the difference before dividing by two, but ordinarily this refinement will not be needed. If the 4th term is over five as in Example I, then the last place found will be from one to three units too great, but if under five it is of no consequence.

If, in exceptional problems, even more places are desired in the root, they may be obtained by squaring the first five or more places already found, obtaining a new half difference, and dividing by slide rule as before.

JAMES L. DOYLE

Fairmont, W. Va., November 13, 1937

Twisted Bar Steel

Sir: I was surprised to note from Mr. Strehan's article "New York's New Building Code" (*ENR*, August 19, 1937, p. 316) that the working stresses in cold-twisted twin bars were 50 per cent greater than allowed in ordinary reinforcing bars. As a member of the advisory board dealing with the revision of the building regulations of the City of Sydney and a member of the committee which prepared the Australian Standard Specification governing the use of structural steel in buildings, I watch very closely the advances which are being made in your building practice.

I have recently seen some pamphlets relating to cold twisted twin bars and am of the opinion that the stresses mentioned therein are excessive.

My chief objections to the excessively high stress preference allowed for this particular type of reinforcement are:

(1) When used in a building of any length where proper contraction joints are an objection, the natural contraction of the concrete at construction joints is liable to cause a fracture of the reinforcement which has had its valuable capacity for local elongation removed by the preliminary twisting.

(2) Indented or corrugated bars were not supposed to require hooks, but under many conditions of loading

hooks have been found essential. As the bond for twisted bars should be similar to that permissible in indented bars, hooks also will be essential, and the hooking may cause fractures which would be a potential cause of failure.

(3) In the majority of structures of any importance advantage should be taken of the compression value of the steel placed in the lower face of beams passing over the heads of columns. In practice the twisted bars will be used for this purpose and owing to their "form or shape" they will have a greater deformation and in thin beams may cause a bursting of the concrete.

(4) In practice any two bars taken from the stock pile for twisting may be quite variable in quality and may even vary in grade; and on this account one of the bars may be on the point of fracture without detection.

(5) Owing to ultimate strength not being increased, the factor of safety against the collapse of a structure is reduced to a dangerous limit. No matter what regulations specify, buildings will continue to be subjected to overloading from time to time, and the appearance of fractures in beams due to overloading, combined with the low elastic limit of ordinary mild steel, is a valuable safety indicator. From the public safety point of view it might be preferable to permit the 50 per cent increase in working stress in ordinary steel rather than allowing it for this class of reinforcement.

A. S. MACDONALD
Consulting Engineer
Sydney, Australia, Nov. 1, 1937

Bottom-Drive Piles

Sir: The article on foundations of the West Side Highway, *ENR*, Nov. 4, 1937, states that shells were driven by a large pile hammer seated on an H-beam across the caisson at the top. This work was done in 1930. I am the originator, and was the first one to use the method of driving large caissons without compressed air by the use of I-beams. Applications for patents were made in 1928, and patents were granted subsequently. The method includes welding one or more I-beams near the cutting edge of the caisson and inserting the hammer or hammers in the caisson. Thus the force of the blow is delivered at or near the bottom instead of transversing the entire length of the caisson. The I-beam can also be placed at any position in the caisson. This method is also known as the bottom drive.

MAURICE BLUMENTHAL
New York, November 27, 1937

Flood Runoff Formulas

Sir: The statement in parenthesis following Eq. 6, p. 866, Nov. 25, refers to an intended revision of the expressions for the terms A and B to make them consistent with Eq. 1. The revised forms of these terms are as follows:

$$A = 645\ \frac{6 + I}{6I + I}, \text{ for } T = 1 \text{ hr.}$$

or less, or

$$A = \frac{645}{T^{0.25}} \text{ for } T \text{ greater than 1 hr.;}$$

$$B = 100\ (z - 1)\ \frac{6\sqrt{T - T}}{0.4I + T}.$$

Eq. 7 was intended to be deleted. In the last equation in the middle column of p. 866 the term i should be inserted after 645c.

VICTOR H. COCHRANE
Tulsa, Okla., Nov. 29, 1937.

Promoting Appreciation

Sir: We are planning an Engineers' Week in Raleigh from January 23rd to 29th. Although this is the first year we have attempted anything of this character and on this scale at North Carolina State College, the object is fairly well defined, namely, to increase the efficiency of the surveyors and engineers and at the same time to develop better social contacts with the professional men of the state.

We are trying, also, to make this a general engineer's week all over the state of North Carolina and are endeavoring to get the Rotary, Kiwanis, Lions, and other civic clubs to devote their meetings that week to the engineering works in their respective communities and to invite some engineer to tell them of these works and their economic and social importance.

If properly planned and sponsored a movement of this character all over the country might react most favorably to the engineering profession. In other words, if once a year we could get the civic clubs to permit some member of our profession to explain to them the importance of the engineering work going on in the various communities, I believe it would do much to create a better understanding and a better appreciation of the engineering profession. Furthermore, it would give an opportunity for a few engineers to get credit for some of their work.

BLAKE R. VAN LEER
Dean of Engineering
Raleigh, N. C., December 2, 1937

Concrete's Permanency

Sir: It is our regular practice to inspect the structures that have been built both by ourselves and by other builders, as the best way to obtain data to use in future work. A few of these works have been built from our own designs, but most of them from plans and specifications prepared by some of the best engineers in this country. All of them were carried out under competent inspection by the owners, whether states, municipalities, or private parties. There have been notable changes in the construction of highway bridges, and designers have followed through from timber or steel to rigid frame concrete, with abutments of rough stone or concrete to expensive stone abutments and arches with concrete intrados.

We are noting that in the concrete bridges there are too many instances of deterioration in the superstructures. This appears to be due to leakage of water through the floors, spandrels, parapets, and arches.

Practically all of these bridges were waterproofed while being built, for the necessity was more or less well understood. Different methods of waterproofing were used, but the results have been about the same. Besides being unsightly, these defects will in time become dangerous to the integrity of such structures.

In view of the foregoing facts, it would seem that there is an inherent weakness in the material of which they were built, that is, in concrete itself, as it was made and used in the past, and as it is made today.

Therefore, unless this fault can be corrected, the slogan of "Concrete for permanence" will have to be understood to mean that, for exposed superstructures, concrete is no more permanent than wood or steel, provided that wood is protected by treatment, or steel by painting.

JOHN G. HOLBROOK
John G. Holbrook & Son
Westbrook, Conn., Dec. 8, 1937

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DECEMBER 16, 1937

GIVING GOOD SERVICE under a business-like system is by no means impossible in city administration, as the story of results obtained at Cedar Rapids, in this issue, demonstrates. Written from the personal record of a keen and experienced observer, the story presents a true picture of the city's water service. Other accounts of similar management results, to follow in later issues, will give further evidence that competent, economical utility service is within the reach of any city provided it is willing to assure its water department the requisite knowledge, autonomy and continuity of service for operation on a consistent business basis. Every waterworks man will find it profitable to read the details of what is being accomplished in the cities covered by these accounts, bearing in mind that like cases can be found in all quarters of the country. Perhaps because water is a primary necessity and so is under the eye of the public, efficient management of water service is making large strides. It is yet far from general, but current progress gives hope that in time it will be found everywhere.

An Important Advance

FLOOD FORECASTING as established in Pennsylvania since the great floods of 1936 sets a new standard of essential public service that ought to find early adoption in other states. The Pennsylvania program constitutes an important and much-needed advance. It has twofold value, for in addition to giving warning of dangerous floods and thus reducing life and property losses it will also extend the now sadly inadequate data on amount and distribution of rainfall. The gain that may be expected from this latter service is patent to everyone who must make water calculations from the present thinly scattered records, and who finds that often he has to guess a bit wildly in filling out the gaps. Under present conditions waste of money in the planning of river work can hardly be avoided; the fuller data furnished by an adequate network of recording gages will make it possible to design more precisely and build more cheaply and safely. With the efficient self-reporting recorders now being put into use the possibilities of rainfall and stream-flow observation are so greatly enlarged as to give prospect of a wholly new scope of water data, to the advantage of public safety and economy.

Industrial Waste Problems

INDUSTRIAL WASTES came prominently to attention recently at Buffalo and Niagara Falls. Experiences there, reported in our news columns, are current illustrations of the well-known fact that some of the most vital and difficult problems of stream-pollution abatement arise from the waste products of industry. These often are much more harmful to stream purity than is domestic sewage, and unfortunately technical knowledge has not yet found simple ways of dealing with them. In most cases they cannot be handled effectively in municipal treatment plants. The problem is one for the industry itself; since poisons or materials of corrosive or explosive character should obviously not be discharged into sewers or streams until reduced to harmless form, it is necessary that industry should make waste-treatment its special study. Much has already been accomplished, but a much larger amount of work remains to be done. In this work industry will find the public authorities ready to give full cooperation.

Parkways Go To Town

SINCE ENTERPRISING Westchester County first demonstrated how to plan and build parkways, much new mileage has been added to the parkway network in the New York metropolitan area. As a result three arterial routes converge on the city from Westchester at the north and two from Long Island on the east. Until recently these arterials ended at the city line; like most cities New York still had only its horse-and-buggy streets to offer motorists. But now the parkways are going to town. Beginning with the Triborough Bridge, whose approaches brought one Long Island parkway into the city, other extensions have been built, and here and there pieces of circumferential arterial routes have been constructed. A further step—and in many respects the most important one—was taken last week when park commissioner Robert Moses requested funds to purchase land for additional parkways which will tie together the loose ends now existing into a continuous network of arterials. Thus does New York City seek to bring its outlying parkways into town. From a national viewpoint, this evolution is important as indicating a type of highway construction that faces every major city.

A Bad Precedent

NON-EXISTENT WAGE RATES can hardly be considered a sound or fair basis of specification of wage minimums for construction of a public-works

undertaking. The Delaware Aqueduct contracts now pending bring up the issue. The minimum wage rates there specified are higher than any scales now paid. To put forward such rates as "prevailing" robs the public and sets a dangerous precedent. In the case of the contracts for the first twenty miles of the Delaware River aqueduct of the New York water supply, the city comptroller, who under the law must ascertain the prevailing rates and certify them to the contracting agency as minimums to be paid, sought and received the aid of the state department of labor, as the site is outside the city limits. The rates in question are those cited by this department. Just how they were ascertained is a mystery which the department refuses to clear up. Suspicion points to undue labor influence. The law requires the public to insist that the contractor pay not less than prevailing rates, but it does not require or permit it to insist on higher wages. The ascertainment of prevailing rates is not a bargaining procedure; it is a simple determination of fact. A false declaration of fact in this instance threatens to mulct the public of millions of dollars. If not revoked and corrected it will also put a sharp brake on improvement enterprise.

Key to Prosperity

A TRADER IN COPPER or in sheep's wool tends to regard his business as the central factor of the general welfare. In the same spirit men engaged in construction believe that active construction makes national prosperity, while dull construction makes hard times. But quite apart from any self-centered opinion there are strong economic reasons for rating construction as the key to prosperity. To sum them up in a word: All other business of the country is concerned solely with producing consumable goods and services and with consuming them, a process that leaves no surplus and permits of no saving. The people engaged in it live, so to say, by taking in each other's washing. Construction alone creates the annual increase in national inventory by which national savings are measured; and in doing so it employs those millions of workers who are not needed in doing the washing. Without construction there can be no profit, nor can there be full employment and full production. It is for this reason that construction is in fact the central item of the country's activities. Investigating the same question from a very different starting-point, William Stanley Parker this week presents a statistical proof. His analysis indicates that nearly all of the depression effect was due to decrease in construction and the secondary incomes which it produces. He establishes a strong case for the claim that recovery awaits the full return of construction. And in doing so he proves also that until we learn to stabilize construction we cannot attain stable prosperity.

Railroad Construction

RAILROADS normally spend large sums annually on construction. Last year, despite their unfavorable financial condition, they spent on roadway and structures $140,000,000; in the decade prior to 1929 they paid out an average of $800,000,000 a year. Hence the construction industry has a large stake in railroad prosperity.

Today the railroads find themselves probably in the worst condition ever experienced in their history. Railroads operating 71,386 miles, or 28 per cent of the mileage of the country, are now in receivership. Part of the trouble is historical, the effect of exploitation by the bankers. But part is of more recent origin.

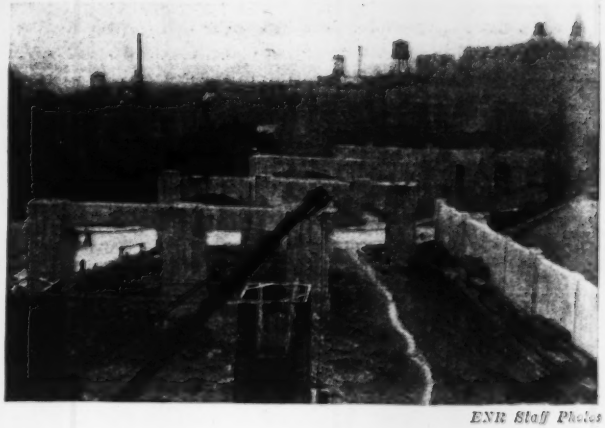
Since 1932, increase in traffic has been more than offset by new increases in operating costs. In 1936 the railroads had a net income of $164,630,000 which was available for new improvements, reduction of debt and dividends. But during the current year their income has been cut $150,000,000 by loss of emergency freight rates, while their expenses have been swelled by increased cost of materials and supplies, $125,000,000; social security and retirement taxes, $59,000,000; wage increases granted under the Railroad Labor Act, $41,000,000. Thus, with $225,000,000 additional expense, their revenues have been cut by $375,000,000. Pending are demands for a 20 per cent increase from the five brotherhoods, $116,000,000, and increased costs of $100,000,000 due to the 70-car train bill now before Congress.

To offset this the Interstate Commerce Commission recently authorized increases in selected freight rates that are expected to yield $50,000,000 annually. Pending before the I.C.C. is a petition for a general increase of 15 per cent in freight rates and 25 per cent in eastern coach fares. This would produce about $507,000,000.

The increase of $660,000,000 in costs since 1933 is largely beyond railroad control. Whether the roads can move back toward financial stability in 1938 is now up to Congress and its agents, the Interstate Commerce Commission and the Railroad Labor Board. The power to increase operating costs of publicly regulated utilities ought to carry with it responsibility for finding the means for meeting those costs, but evidence of the correlation of these two is notably lacking. It is easy to respond to the importunities of pressure groups, and hard to carry that action to its logical conclusion.

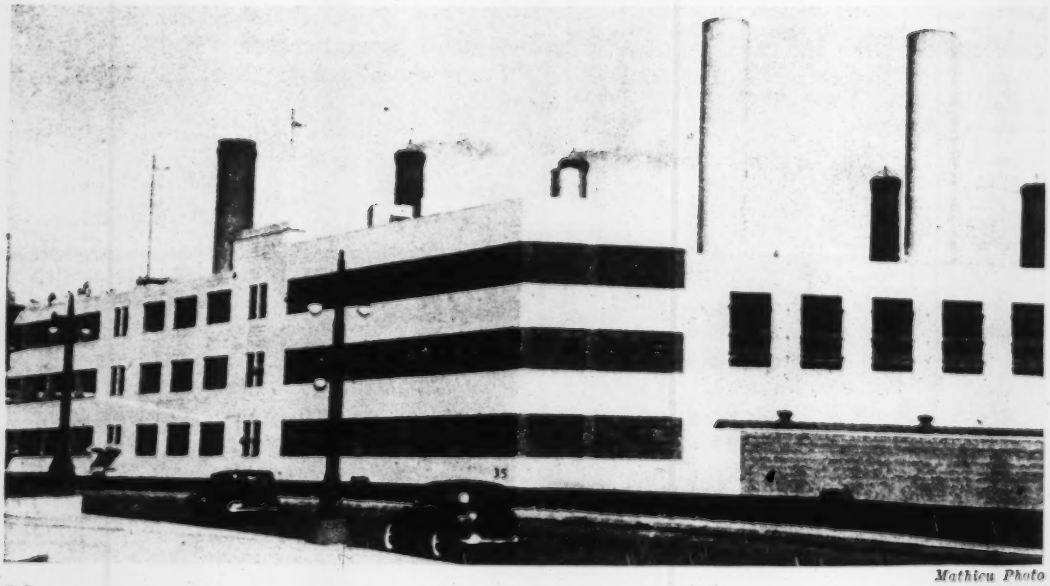
If the I.C.C. should act favorably on the petition for a 15 per cent rate increase, and if the Railroad Labor Board should turn a deaf ear to the demands of the best paid groups of railroad employees, the railroads may be on the road to normal conditions in 1938. If they are, the construction industry may see more normal expenditures for new facilities.

PICTURES IN THE NEWS



ENR Staff Photos

PROVIDING BETTER HIGHWAY FACILITIES for Ohio. Above are shown three arches of the Little Miami River Bridge at Foster's Crossing, Ohio. At right, traffic will be brought into Cincinnati over this elevated roadway, part of the city's Columbia Ave. improvement.



Mathieu Photo

NEW YORK'S NEW WEST SIDE INCINERATOR. This structure, recently completed, replaces an old plant at the same location. In the foreground a section of the west side elevated highway is seen.

Construction and National Income

by William Stanley Parker
Architect, Boston

National income fluctuates with construction activity, on the way down and in recovery, which means that prosperity waits on revival of normal construction

For some years it has been held by leading economists and construction men that general prosperity is dependent on the amount of construction activity. Strong evidence supporting this belief is brought forward by the author through a new form of analysis of depression statistics. He finds that as construction slowed down from its 1928–29 rate the national pay envelope grew slimmer, and likewise that construction recovery after 1933 was matched by increase in income. His conclusion: To cut down the relief roll we must speed up construction. —Editor

Construction is said to be the second largest "industry" in the country, second only to agriculture. How much of the national income is created by the operations of this industry?

Whether the depression caused the slump in construction or vice versa need not be decided. Let us assume that some outside cause led to stagnation of all forms of enterprise, and then let us analyze the results of this stagnation to learn how much of the loss in national income was due to the lessened activity in construction.

It will perhaps be well to point out here that this process of appraisal cannot be applied to all other classes of activity, and the sum total of all results made to equal the national income. Duplications make this impossible. For example, some of the elements of construction represent capital investments in agricultural or manufacturing enterprises, and the secondary incomes resulting from primary activity in construction constitute parts of agriculture, retail merchandising, manufacturing and service activities. Nevertheless it should be possible to determine how much the general prosperity suffers from a falling off in construction.

If the activity of the construction industry is charted in relation to the national income, the chart enables us to trace its fluctuations and compare them with the fluctuations in total national income. A consistent relationship between these two fluctuating totals would naturally imply some direct relationship.

Data of the comparison

A few assumptions are necessary as a basis for the graphic comparison. They are somewhat arbitrary, but reasonable, and, if they are finally shown to be in some degree in error the conclusions are not necessarily invalidated. I believe that revision of the diagram to fit any other reasonable assumptions would not change the essential indications but would merely modify their relative intensities.

The assumptions are:

(1) The national income is that given by the Brookmire Bulletins, Inc. Several national estimates vary only slightly. Any of these estimates would serve equally well.

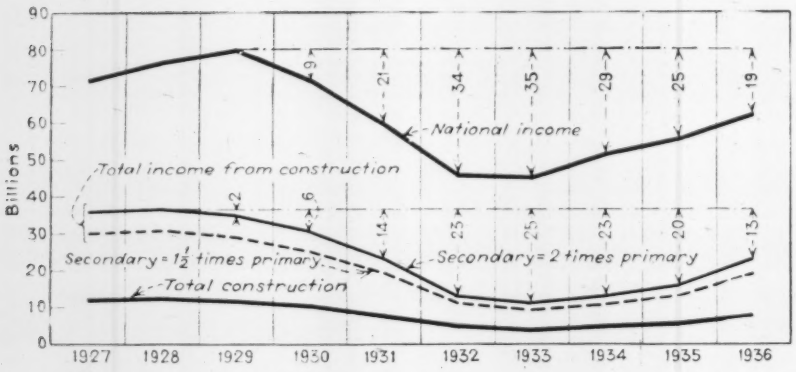
(2) The total construction for each year, including private construction, public works and public utilities, is that given in the Department of Commerce bulletin on the construction industry of April, 1936 (the amounts indicated for 1935 and 1936 are based on additional information available since the Bulletin was issued). The figures given are primary expenditures, and include both direct labor, or labor on the site, and indirect labor, or labor involved in producing, fabricating and transporting the materials and equipment to the site plus all other items of cost incidental to the work.

(3) The secondary expenditures (for consumers' goods and services) that result from the primary expenditures on construction work are variously estimated. Such estimates are based upon many subordinate assumptions. It is generally held that secondary expenditures vary according to surrounding conditions, tending to be relatively less in a period of depression and more in periods of good business.

The curves in the diagram (next page) show indications based upon two assumptions: (a) $2 of secondary for each $1 of primary within the year; (b) $1.50 of secondary for each $1 of primary. A third possible assumption is to use a combination of the two, that is, to use a ratio of 2 to 1 during the good times up to 1929 and in the period of renewed hope beginning with 1935, and a ratio of 1½ to 1 during the intervening depression years.

Of course, the repercussions of the expenditures in the latter part of any year extend into the next year. For the purpose of this study, however, the above assumption is believed to be sufficiently accurate, especially in view of the fact that there is no general agreement on what the actual factor is that represents the secondary spending.

The peak of construction was reached in 1928, while the peak national income was earned in 1929. A fictitious prosperity continued for a year after construction had started on the down grade, sounding the danger signal that seemed to go unnoticed. At the construction peak, 1928, primary expenditures were about 16 per cent of the national income; at the depth of the depression they were about 8 per cent. Taking the primary and secondary incomes together (on the 2 to 1 assumption for secondary) the construction industry accounts for 48



National income fluctuated in direct ratio with total construction income throughout the depression and during recovery.

per cent of the national income in 1928 and 25 per cent in 1933. If the 1½ to 1 assumption is used, the percentages are correspondingly somewhat lower.

Since the construction industry represents substantially all the capital goods activities, the remainder of the national income represents almost entirely the consumer goods and services and manufactures not connected with or resulting from the work of construction. It is commonly noted that in periods of booms and depressions the production of capital goods fluctuates widely, while production of consumer goods, representing many basic necessities, tends to fluctuate much less.

What the diagram shows

The diagram above shows for each year after 1929 the reduction in the total national income below the 1929 peak, and after 1928 the total reduction in the primary and secondary construction income below its 1928 peak. How do these statistics given compare?

In 1929, construction (hereafter this term will mean the total of primary plus secondary construction incomes on the 2 to 1 assumption) showed a loss of two billions, while Wall Street had lifted the national income some 4 billions. In 1930 construction showed a total drop of 6 billions, the national income dropping 9 billions. At this time the country was completely cured of speculation, and the currents of national income thereafter acted more normally according to surrounding circumstances.

Comparison of the two sets of figures now takes on a significant uniformity. In parallel columns the figures for reduction in national income and in construction are:

DEPRESSION EFFECTS
(billions of dollars)

	National Income, drop from peak	Construction, drop from peak	Construction drop in percent of income drop
1931	21	14	66
1932	34	23	68
1933	35	25	71
1934	29	23	79
1935	25	20	80
1936	19	13	68

These show a very steady general relationship. Great accuracy cannot be claimed for the yearly figures for construction, especially as the larger portion of each is secondary income based upon an assumed factor. *The significance of the diagram lies in the fairly consistent relationship of the loss in construction incomes to the loss in national income.*

The diagram indicates that the drop in construction accounts for about 73 per cent of the drop in the national income. And the result is affected only slightly if we accept the smaller ratio of 1½ to 1 to indicate the secondary incomes. On this basis the above table would be changed as below, with an average percentage of about 68:

FOR CONSTRUCTION RATIO OF 1 TO 1½

	Income drop	Construction drop	Percent
1931	21	12	57
1932	34	20	59
1933	35	22	63
1934	29	20	69
1935	25	18	72
1936	19	12	63

If the other alternative assumption first mentioned is accepted, viz. a ratio of 2 to 1 during good times and 1½ to 1 during the deep depression (1930 to 1934), there would be an increase in effect, as the accumulated losses in construction incomes would be greater, being measured from the higher peak to the lower valley. On this basis the table is:

FOR VARIABLE CONSTRUCTION RATIO

	Income drop	Construction drop	Percent
1931	21	17	81
1932	34	25	73
1933	34	27	79
1934	30	25	83
1935	25	20	80
1936	19	13	68

The same regularity of relationship appears here, but construction loss accounts for about 78 per cent of the loss in the national income. In other words, the effects of the slump in construction activity account for all but one fifth of the loss in national income. It is quite possible that the secondary incomes flowing from construction activity are large enough to account for all the loss in national income.

If this diagrammatic study is free from any fundamental fallacy it may be said to confirm the generally accepted statement that the recovery of national prosperity requires a recovery in construction. This in turn means that reduction in relief expenditures can be accomplished only by an increase in construction until it resumes its normal place in the national economy.

Construction is still some 5 or 6 billion dollars below its previous total. On the 2 to 1 ratio for secondary incomes this means a loss of 15 to 18 billions of national income. If by 1936 construction had returned to normal and federal relief expenditures had been reduced by a billion, the net gain in national income would be 12 to 15 billions above the actual 1936 gain shown in the diagram; in other words the total national income would have been 74 to 77 billions, which is almost up to our 1929 peak. By 1937 that peak would be exceeded. Of course our population increase demands some such increase.

To summarize: If the country wants to reduce its relief expenditures it has only one adequate means at its disposal and that is an increase in construction. So long as private construction doesn't take on the load, public works must carry it. And public works is itself still below its former peak.

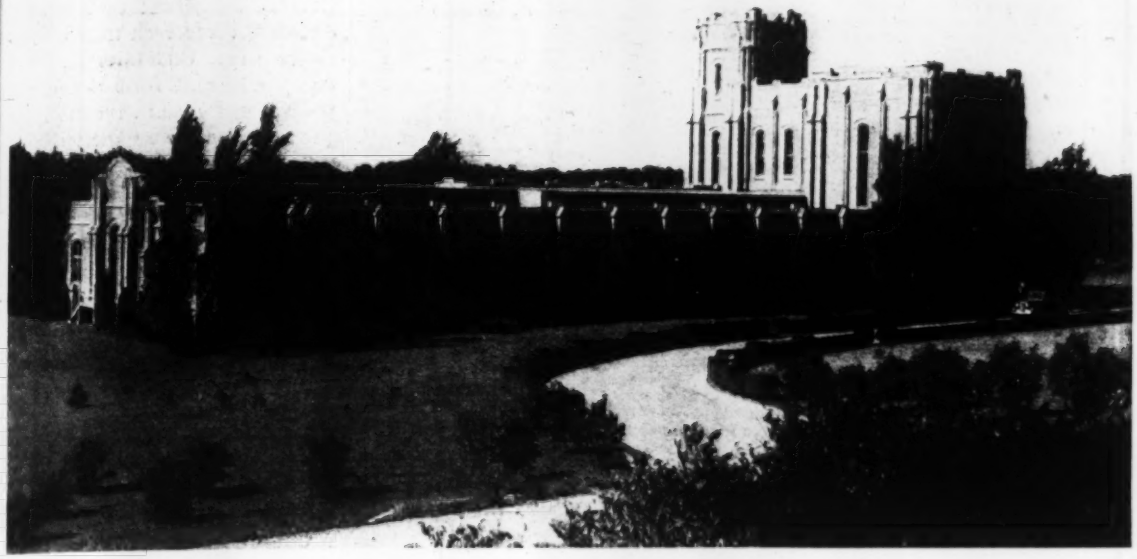


FIG. 1. CEDAR RAPIDS' WATER PURIFICATION PLANT IS WELL GROOMED IN ITS RURAL SETTING

Plenty of Good Water at Low Cost

by W. W. DeBerard

Associate Editor, *Engineering News-Record*, Chicago, Ill.

With a workable organization setup, the Cedar Rapids, Iowa, Water Department produces a quality supply and distributes it economically

BELIEVING that water is the most necessary of commodities with which American cities provide their citizens, the Water Department of Cedar Rapids, Ia., takes great pains to leave nothing essential undone to provide quality for health, quantity for fire and reasonable cost.

A modern filtration and softening plant was completed in 1930. Its capacity is 12 m.g.d., and the maximum demand is 8½ m.g.d. A recent analysis of prices charged for 3,000 cu.ft., an average 6-months bill, in many Iowa and midwest cities of similar characteristics put Cedar Rapids at the foot of the list at $1.25. The mid-point was about $7.50.

How, then, does this typical prairie state municipality on the sizable Cedar River accomplish these three objectives of quality, quantity and low cost? It should be recalled that the river drains an agricultural limestone watershed with its alternate turbidities and hardness, and that in spring breakups carries organic matter from sloughs. In the summer's low-water period fairly clear waters of high hardness come largely from underground. A day with H. F. Blomquist, superintendent, convinced the writer that these varied obstacles had been overcome and the three objectives had been accomplished.

Run as a separate utility

In the first place Cedar Rapids has a commission form of government, the council being made up of five members; mayor, commissioners of public works, safety, welfare and finance. The council appointed Mr. Blomquist superintendent of waterworks 17 years ago and at 2-year intervals has reappointed him. In essence he is the general manager as well. The department is run as nearly like a separate utility as is possible under existing statutes. There is no board of waterworks trustees, and while the waterworks is directly under the council as a whole the council has designated the commissioner of finance as contact official between it and the waterworks. The superintendent's job is to accomplish the above named objectives at the minimum cost, cost meaning operation, maintenance and amortization of indebtedness for new facilities as the needs arise. The costs must all come from revenues derived from services. The superintendent originates, plans and specifies the day-to-day expenditures as well as major outlays. Council approves the policies and final vouchers, which are paid by the city treasurer, in whose water account each day's collections are deposited.

No. 646400 Kind Worth D 5/8" Location 144 24th St. SE.

WATER METER REPAIR COST CARD Job No. 29191

Date 9-21-37 19 In 17-41 xx Out 17-42 Reading 53800

Cause Leak in stuffing box

MATERIALS USED	$	Cts.
1 Case Gasket		
1 Stuffing Box Spindle		
1 #2 Pinion Spindle Gear		
1 #3 Pinion Spindle Gear		
1 #3 Gear Stud		
TOTAL MATERIALS		

Tests Before and After Repaired

	Before	After
5/8" Steam	2 % F	2 % S
1/4" "	2 % F	2 % S
1/16" "	2 % F	2 % S
1/32" "	R %	10 % S

Costs

Time 1 hrs. at c $

" c

Draying " c

Materials used

Total cost $

Cost charged customer $

Cost Index Bal.

Fig. 2. **Water meter repair cost card records also gear changes, reading, cause of repair, labor, materials cost and accuracy before-and-after.**

This water account is kept entirely separate from all others, and transfers to make up tax or other deficits are not made. In consequence amortization at present is ahead of schedule several thousand dollars through purchase of bonds before maturity. Due to the high rating, less than 3 per cent basis, few bonds are available. The above indication of continuity of service, cooperation of planning and administration, placement of the department on its own bottom financially has made possible a system comparable to that of the better utility corporations.

Metering for efficiency

Since the basis of efficient financial management is a carefully worked out collection system in which the proper measurement and unit pricing of the commodity sold is highly important, services in Cedar Rapids are wholly metered. Tight supervision over the cash production mechanism is therefore considered one of the superintendent's prime duties. The methods employed are not complicated or hedged around with red tape and excessive record keeping, but are calculated to keep the customers' bills straight and maintain good will.

The department owns and maintains all meters, which are set in basements to prevent freezing. In new houses, after completion and inspection of the plumbing, the meter is set by the department in a place provided by the plumber.

Tests are made on all meters prior to setting and errors of more than 2 per cent corrected by gear changes. With Cedar Rapids water, meters usually run fast within 6 months to a year after setting, so that it is the practice to set meters 2 per cent slow. The majority of complaints arise from the customer feeling his meter is fast—and he is quite often right. Meters are removed, however, upon report of meter readers that the meter is not registering, or of the office that the reading is out of line—slow or fast. It is the policy to overhaul all meters after they have been in service 7 to 10 years, a card file showing date set, meter number and location. This is provided for constant reference.

Three meter service men, each provided with a light delivery truck, remove and replace meters. For sizes 2-in. and larger a helper is given the service men.

Test procedure

Meter maintenance and testing is carried out in a shop at the site of the former plant near the business center of the city. A chief meter tester, three mechanics and a record keeper are employed here. Two testing machines for ⅝ to 2-in. meters are provided. They have 12-cu.ft. tanks mounted on scales with three beams; one registers pounds, one cubic feet and one percentage errors. Tests are made of the meter as received and after repaired; a notation is made on a record card of materials and time to be charged as well as the errors before and after repair on 5/8-, 1/4-, 1/16- and 1/32-in. streams. A typical card is shown. these are made each time a meter is in the shop. Quantities used in the tests are 10 cu.ft. for 5/8- and 1/4-in. streams and 1 cu.ft. for the 1/16-in. streams. For the smallest size notation is made as to whether it will run or not. The 1/16-in. tolerance is 10 per cent.

As noted above, gears are usually shifted to produce a 2 per cent slow registration, as wear on the mechanism tends to reduce friction and speeds up the registration. On occasion a meter is found with a slime growth which reduces slightly the chamber space, thus increasing registration. Another cause of speed is wear on the "ball" bearing at the center of the disk of a nutating type of meter. Thin shims can build out these "balls." Teeth in one set of gears run in the twenties and another in the forties so that it is easy to shift speeds to make corrections. The chief tester has a chart showing combinations which accomplish the desired results. Pinions are always renewed and stuffing boxes repacked.

Handling complaints

Unless negligence, such as freezing in a cold house or a backup of hot water is evident, the city bears the cost of test, repair and replacement. Most complaints come in the summer following the sprinkling season, when people use more water on their lawns than they think they do. Looking over a hundred reports of complaints with results of meter tests few were found slow, many meters registered perfect and about two thirds from 1 to 4 per cent fast. Liberal adjustments are made with the complaining customer, the percentage allowed usually going back over a 2-yr. period. It is felt the good will of the customer cannot be easier retained than by being more than fair in such cases. Meters on domestic services are read every 2 months and on commercial and industrial meters every month so that early discovery of leaks or unusual registrations are quickly caught up.

Mr. Blomquist feels that good meters should last 50 yr. if parts subjected to the most wear are replaced. Some have been in service in this system for 40 yr. One 21 yr. in service without removal registered within 2

per cent of correct. It pays to buy good meters, so Cedar Rapids thinks, and cases of these are rarely thrown away. In fact a lot of "turned in" second hand meters was recently purchased at $1.50 each from a meter salesman, and few were found that were not serviceable at an expenditure of $2 to $3 for parts and labor. The limit for repairs is set at $4 to $5, averaging a dollar less than this.

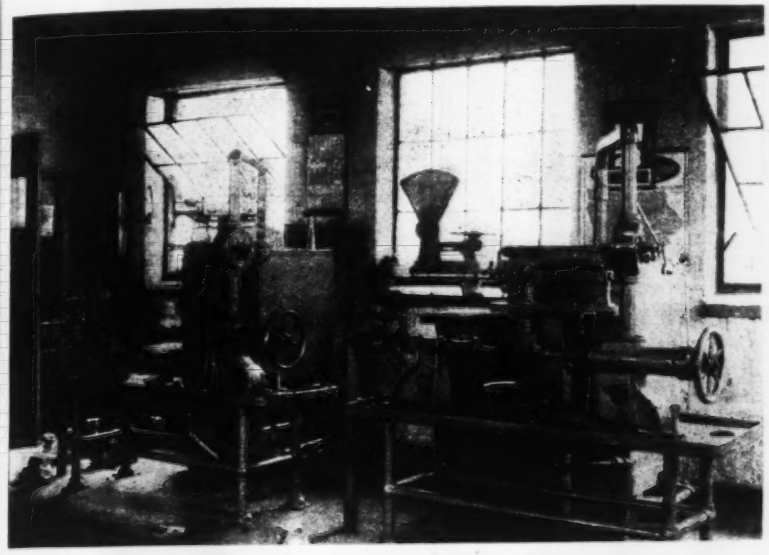


Fig. 3. Two meter testers, handling up to 2-in. sizes, have 10-cu. ft. tanks on platform scales behind them.

With meters so closely watched, it is natural to assume that leakage in mains would be closely checked. With a terrain of sand and clay, leaks show on the surface quickly in the latter but not so soon in the sand. A pitometer survey made in 1925 showed that the system was one of the tightest which had been inspected by the company making the survey. Except for sewer flush tank leakage from worn out plug nozzles and a few services little leakage was found. No leaks on mains were discovered. The flush tanks used 500 gal. per flush and the 200 then in service now have been reduced to 125. They are checked every 2 years.

Fortunately, from the consumption standpoint, the temperature of the river water is too high in summer to be suitable for air conditioning. Artesian water struck at 1,050 ft. rises to within 18 ft. of ground level. When the first well was sunk long ago, it rose 18 ft. above ground. A ground water in the dolomite formations 250 to 350 ft. down produces a 55 to 58 deg. water and is being utilized for larger commercial installations of air conditioning.

Hydrants well supplied

Aside from a good generous distribution grid system for fire fighting purposes is a close inspection of fire hydrants. Few mains are less than 6-in. in size, and all branch hydrants set during the past 20 years are 6-in. The 4-in. mains are in outlying areas or in streets that have large sewers and have a main on each side of the street, but the 4-in. size never has a fire hydrant connection. Grids and feeders are usually 12 in. or larger.

Beginning in September, all hydrants are inspected and the job completed by the middle of December, when freezeups may be expected. Stuffing boxes are repacked, greased or tightened, and particular attention is paid to leaks, as few hydrants will be injured by freezing unless there is water in the barrel. In the congested value and business district one man is continually checking over hydrants, every one being covered once in a week or ten days, especially in cold weather. The fire department also details a man for similar service in winter. Only two hydrants were found in need of service last winter, and no difficulty was met in the extreme winter of the previous year. If hydrants are kept dry no trouble is experienced.

Maps show hydrants

Of importance to fire fighters as well as waterworks maintenance men is an easily available record of valve location. Such a record including hydrants in Cedar Rapids is kept in two books; one, on a scale of 600 ft. to the inch, shows location alone with principal mains as a skeleton map with names of streets noted, but not street lines. These are in 11x17-in. size, overlapping sheets covering the city. The second record is a loose-leaf book with metal covers for 5x9-in. printed sheets of three intersections along main streets. Mains, branches, tees, crosses, valves and hydrants are noted with distances away from lot lines. Most valves are placed on lot-line extensions if possible. Lot lines are usually 2 ft. inside of the inner sidewalk line. Irregular street

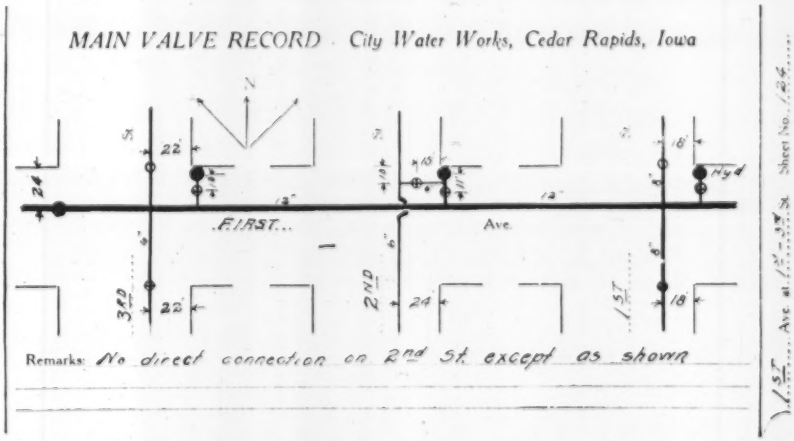


Fig. 4. The main valve record is kept in three books; one for superintendent's car, one for the service yard and a third locked in a vault for permanent safekeeping.

patterns are plotted on the back of the sheets. Three of these books are made up. One is kept at service yard, one in the superintendent's car and a third one is locked in the vault in the municipal building.

To keep close track of materials a continuous inventory is maintained on a card system in which 4,000 items or accounts are posted when material is purchased, and charged out when used. Each item such as a single pipe length or a valve is charged out with its proportionate share of original cost, plus freight, cartage, etc. Thus at any one time the amount of material on hand can be checked with the material in stock. Once a year a physical inventory of the department's materials is made.

Purification system revamped

As the filter plant was completed only seven years ago not much maintenance has been necessary. On the occasion of the recent inspection, a motor driving the smallest of the three centrifugal units was down for cleaning and revarnishing. This unit has been in service a large portion of the time since operation started and had not been down previously.

In the purification end of the station, which does water softening, some replacements and revamping have been made. For instance the original CO_2 scrubber was a sheet-steel shell lined with concrete. It had cast-iron grates in the bottom. The corrosive action of the gases had attacked the sheet in 3 years, and replacement became necessary. A 13-ft. section of 36-in. asbestos-cement pipe was cut in half to make two 6½-ft. scrubbers. The half pipes were set on end with an oak grill in the bottom which was built up out of concrete with a lead-lined conical collector space below the grill to carry off the water which is sprayed on to the top of the coke with which the pipe is filled. The water enters a 10-in. pipe from the furnace and is led into the lead-lined collector then rises through the coke and is carried through a 16-in. short section of similar pipe filled with excelsior, thence via a cast-iron pipe to the recarbonization tanks alongside the settling tanks. A concrete slab forms the cover of the scrubber and supports the water spray pipes over the top of the coke.

No corrosion has been noted in the galvanized wrought-iron pipe grid in the recarbonization tanks but the scale deposited in the orifices is punched out whenever the tank is out of service for cleaning, usually about once a month. These holes are 1/16-in. drilled on 3-in. centers, and originally were turned down. For cleaning they have been turned up and left in that position as the distribution of gas seems not to have been affected. At Columbus, Charles P. Hoover uses two rows of holes staggered, turned up. In winter the daily 130 gal. of oil burned in the furnace produces more gas than needed, and the 60 to 80 gal. burned in the summer produces more heat than can be used for hot water in the laboratory and lavatories. Hence gas is a byproduct in the winter and heat a byproduct in the summer months of the year.

Operating results

For best operating results activated carbon has been added at the river low-lift pumping station some 40 min. ahead of the lime solution. The carbon applied is 30 to 60 lb. per m.g. with outside limits from 25 to 200 lb. It is used only 8 mo. per year. The water is 1 hr. in a premixer of ½-m.g. capacity, then passes to 1-m.g. clarifiers which in summer to keep fresh are cleaned every 3 to 4 weeks. Then after from 1/3 to several grams of aluminum sulphate have been added to precipitate the last of the lime the water enters 1-m.g. settling tanks cleaned three or four times each summer.

An average reduction in hardness from 11 grains per gallon to 5½ grains was obtained in the year ending Mar. 31, 1937. Chemicals used per million gallons in this year were as follows: Lime, 1,220 lb.; alum, 235 lb.; chlorine, 10.6 lb.; ammonia, 1.7 lb. A total of 38.4 tons of activated carbon and 13.2 tons of suspension catalyzer were used.

From December to March, cleaning is not attempted on account of freezing weather. In fact, both of the settlers and the clarifiers freeze over with a maximum of 30 in. of ice, which is cut at the sides to prevent bursting of the tanks. Formerly the scraper mechanism was kept going and the support of the rig which extends to the corners of this square tank was removed during winter. However, the whole mechanism has been shut down for 2 mo. during the last two winters. The mixers and recarbonizers have sufficient agitation to prevent freezing. After settling the pH is usually 10.2. It is reduced by the 8.6 p.p.m. of CO_2 added to a pH of 8.5 and a phenolphthalein alkalinity of 2 to 5 p.p.m.

Algae growths on the sides of the recarbonization tanks have been kept down by using 24 lb. of copper sulphate per day. Ordinarily the algae disappear sometime in August or September.

Grounds are attractive

Much attention has been paid to appearance at the purification plant, which itself was given excellent Gothic architectural treatment by the designing consulting engineers, Alvord, Burdick & Howson. After completion, the 11 acres of grounds were well landscaped and planted with trees and shrubs. A box hedge of privet at the entrance is the pride of every citizen who visits the plant with an out-of-town friend. A trim a week keeps the foliage close and thick. The lawn is sprinkled from a set of surface pipes made from tubes from boilers removed at the old downtown station. The lines have welded joints and are laid on gradients to drain in winter.

The financial picture

Total income of the waterworks was $217,750 for the 1937 fiscal year ending Mar. 31 and $238,300 for the previous year. Operating, maintenance and general expenses were $117,600 and $136,150 respectively. Bond interest was $34,650 and $32,750, depreciation $44,200 and $41,400, leaving a net income to the property account of $21,350 and $28,000 for the two years respectively. Permanent improvements and main extensions have averaged $25,000 per year for the past several years. The total assets are carried at $2,236,000, of which the distribution system is $1,277,400, the pumping plant and purification works $567,500, a power dam $152,000 from which a $11,500 annual rental is obtained, cash in the bank around $50,000 and an inventory of $95,600. Bonds outstanding are $725,000 which with miscellaneous items brings the liabilities to $770,750 and the net worth to $1,515,500.

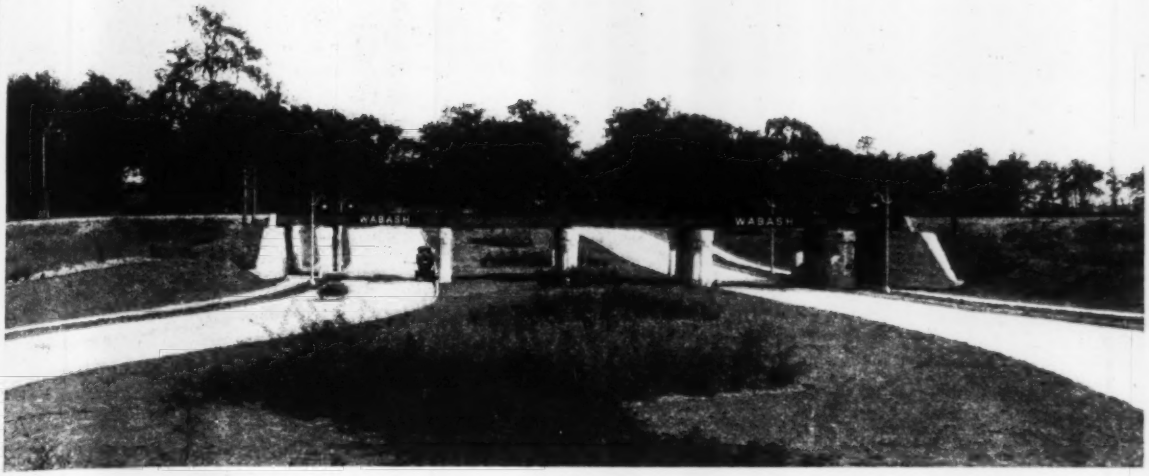


FIG. 1. GRADE SEPARATION OF A DUAL ROAD AND A RAILWAY TO PERMIT FUTURE ROAD WIDENING

Operating County Roads for Safety

by LEROY C. SMITH

Engineer-Manager, Wayne County Road Commission, Detroit, Mich.

Safe operation of its roads by design, upkeep, marking and signaling is held to be supremely a function of highway management in Wayne County

WITH THE DEVELOPMENT of engineering technique and a master system of highways and superhighways (*ENR* Nov 11, p. 791 and Nov. 25, p. 857) operation for fast and safe travel became a paramount duty of the Wayne County road management. Obviously, operating a road system for safety is as vital a function in serving highway transport as is the construction of the system. This postulate is recognized in the organization for highway improvement of Wayne County by creating a safety and traffic division with a civil engineer in charge. The work of this division is the study of safety measures and a systematic check of accidents and their causes. No circumstantial account of these activities is practicable in reasonable article space, but the important thing to note is that they are recognized as a function of highway engineering as it is practiced today.

Operating for safety presumes that, to start with, a safe road structure exists. A safe track must be provided upon which to run vehicles, and it is the duty of roadbuilding agencies to provide this safe track.

Even though it is claimed that safety was embodied in roads built ten or fifteen years ago, many factors of the problem have changed with time, and change will continue as the practices and habits of traffic change; then the safety that is built into the road has to be preserved and often improved by maintenance. Design and upkeep as well as marking and signaling are thus parts of Wayne County road operation for safety.

Design for safety

Safe road design includes many requirements; in general they have become well known through experience, and discussion and time need not be taken to name them. The important thing is to make what is known an essential part of practice. In current planning adequate widths of parking lanes are provided in built-up communities and wide shoulders provided on rural roads. In many cases these shoulders are 15 ft. wide, but are never less than 10 ft. The success of a general plan of wide shoulders is dependent on adequate right-of-way. When this is available in addition to providing the wide shoulder, it is possible to move side ditches to safe distances from the traveled roadways, and where it is impossible to move the ditches to safe distances they are replaced with tile.

It is general practice to provide adequate guard fences on all roads; when there is the least doubt as to the safety of a roadway a guard rail is always placed. All cross tile are marked with white posts. Sight-distance, alignment, superelevation of curves, surface evenness, skid resisting surfaces are all considered in the light of modern traffic speeds. And finally separation of opposing traffic by dual roads, grade separation and safety intersections are provided where practicable.

Safe roads must be kept safe; this is the task of maintenance. The rule of operation is that all roads must

be maintained in such condition that the public may make use of them at all times. In order that this may be successfully accomplished, it is necessary that budgets be carefully prepared, activities be distributed throughout the county and an efficient organization be set up to carry out the program.

Organization—The entire maintenance organization operates under the direction of the maintenance engineer. He directs not only the actual field operations but also all related engineering work, and determines the type and extent of the work to be done.

In addition to the work of the road commission, there is a systematic regulation and control of private work on county roads. Permits are issued by the maintenance engineer for all such private work. Two inspectors are in charge of the work done under permits, such as the installation of utilities, pipe lines, sewers and structures; the construction of private walks and drives and the breaking and replacement of pavement involved in private work of any nature. These men are deputized and also act as weighmasters for enforcing the load-limit laws.

Maintenance Districts — In the routine work, the county is divided into seven maintenance districts with a district foreman in direct charge of all activity in his district. These foremen receive their orders from the maintenance superintendent. A sign foreman is in general charge of the painting and installation of all signs and markers.

Four maintenance yards have been established to aid in carrying on the work. The general repair and paint shop is located at one of these yards where all major repair work of maintenance equipment is performed and the equipment kept clean, painted and in good operating condition at all times. At the other yards only minor repair work is performed and these yards serve chiefly in storing maintenance materials and equipment used in that area.

Scope of Activities—The work of the maintenance division is divided into two groups: first, maintenance which is purely the care of the road after it has been constructed; and second, betterments which involve such activities as resurfacing, the construction and reconstruction of culverts, the construction of guard fences and the placing of traffic signals, signs and markers.

The quality of a road is measured by its surface, and to maintain the surface, it is necessary to give it constant service. Joints and cracks in pavements are kept filled with bituminous materials. Tar crews operate on a defined program and every paved road in the county receives constant attention. Depressions and settlements are raised or patched. In cases where definite breakage occurs or cuts are made, new concrete is placed. One of the principal methods used in raising pavements that have settled is the mud-pumping method; this has also been used in increasing the superelevation of curves.

Shouldering and ditching are other important operations which are given constant attention. All ditches are kept clean by crews which are constantly busy cleaning ditches and culverts which have become clogged by grass, leaves, weeds, debris, and washouts. Shoulders are necessary on a road chiefly to provide safety. These are kept smooth to permit surface water to drain into the ditches. On the more important roads, the shoulders adjacent to the pavement are gravelled. Catchbasins, gutters, and sewers receive periodical cleanings for efficient operation.

Unpaved Roads — On unpaved roads, the maintenance division performs all surfacing operations. Some of the roads are plain gravel or crushed stone, while others are oil-bound or surface-treated with other bituminous materials. Special care is given to drainage on these flexible type roads, as these roads are only as good as their foundations. The gravel roads are dragged and scraped continually to eliminate ruts caused by traffic. Earth shoulders are also maintained on these roads.

Related Activities—The numerous related activities of maintenance includes the placing of direction and warning signs and markers; the moving of fences to proper right-of-way lines; the taking of traffic censuses, and incidental work involved in small bridge and culvert maintenance.

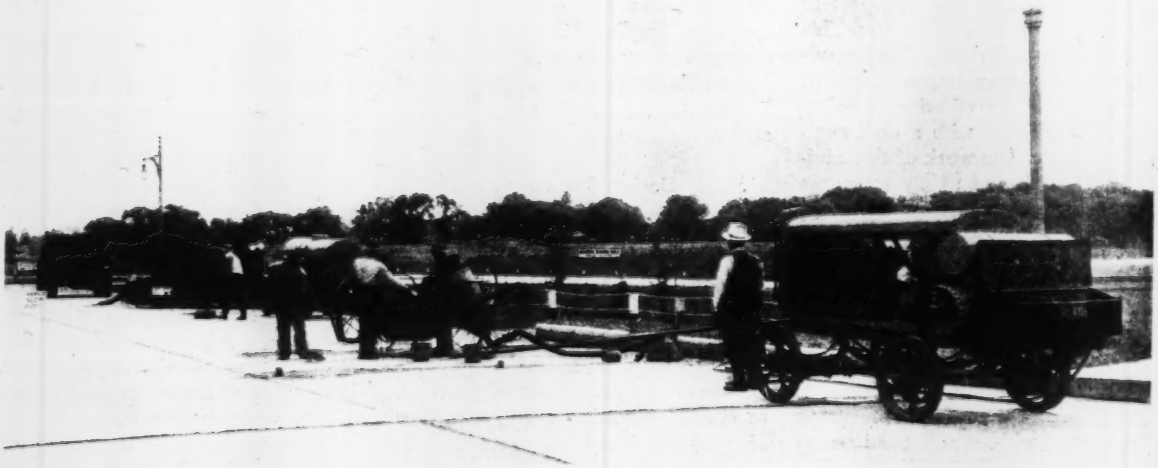


Fig. 2. Sunken surfaces of old pavements are restored to correct level by mud pumping.

The reflector button sign has been adopted as an ideal type of warning sign and this type is now being used on main roads. At major intersections, a sign bearing the name of the intersecting road is placed about 200 ft. from the intersection. These signs are reflector button signs and eliminate the placing of additional warning signs. All dangerous curves are marked with reflector signs, as are school zones.

Traffic counts are taken periodically and the results form a basis for future designs.

Traffic Lines—All pavements are marked with traffic lines. The longitudinal joints placed in pavements form traffic lanes, and in addition to these, traffic lines are placed to control the movement of traffic in opposite directions. On old pavements, the lines are painted periodically to insure visibility at all times; on new pavements, the white traffic line is an integral part of the pavement.

The permanent white traffic safety line is constructed of white cement, white marble sand and rewashed pebbles. The space to be occupied by the safety line is made by imbedding forms of designated dimensions in the pavement adjacent to the pavement forms immediately after the spading and initial screeding of the pavement surface. The finishing machine is allowed to pass over the forms and the ordinary finishing operations are carried on with the safety-line forms in place.

After the final finishing of the pavement surface, and as soon as the edges of the standard concrete in the pavement slab will remain vertical, the safety line forms are removed and the space is filled with the white concrete. The pavement surface upon which the white concrete is placed is roughened to provide bond. Special precautions are taken to prevent staining during curing operations. The traffic line being placed at the present time is 8 in. wide and 1¼ in. thick. In the case of asphalt pavements, the traffic line is made an integral part of the base.

Signal Lights—Signal lights are of two types, the stop and go and the flasher. Stop and go lights are placed at the most important intersections, while the flashers are placed at major intersections where the flow of traffic does not warrant the stop and go signals. At certain intersections, signals are operated as stop and go Sundays and holidays when the flow of traffic is great and as flashers on week days.

Fig. 3. A reflector button night sign is widely used on Wayne county roads.

Caution and Danger Signs—Caution and danger signs are placed where dangerous conditions exist. On main roads, these signs are of the reflector button type. Road direction signs and dangerous intersections are well illuminated by floodlights.

The location of signs is determined after due consideration of their usefulness in warning motorists of traffic hazards. Some signs often seem unnecessary, a few may be out of place but the overwhelming percentage of them mean lives saved when they are obeyed.

For some years past there have been a number of serious accidents caused by automobiles crashing into center piers of grade separations. These piers always have been considered well lighted by 500-watt incandescent lights housed in ornamental lanterns. After a thorough investigation of the lighting of the piers at night, a new marking and lighting system was designed. This new design calls for the painting of the piers a checkerboard of black and yellow 6-in. squares and the bolting of a reflector button sign in the center about 4 ft. above the pavement. The old ornamental light is replaced by a semi-concealed lighting fixture carrying a 200-watt lamp and a reflector which directs the light in an effective manner upon the pier face.

Another safety measure recently undertaken is the construction of pedestrian underpasses on one of the major thoroughfares in a business section. These underpasses are reinforced concrete tunnels, 6 ft. 7 in. wide, 7 ft. high and 106 ft. long. They are well lighted and drained and are lined with glazed brick to prevent defacement and to preserve cleanliness. Provision has been made for flushing and every effort has been made through waterproofing and outer soil drainage to minimize leakage and sweating of the tunnel walls.

Realizing the many hazards attached to work on roads as heavily traveled as those of Wayne County, every effort is made to safeguard workmen from accidents. Protection is given the men both by the use of mechanical guards and by training them to work in a safe manner. However, at least one year's experience in road work is necessary before the men can be trained to work safely.

All work in progress along county roads is protected by well painted barricades, red flags, warning signs, and flagmen where necessary. At night all construction work is lighted by red lanterns, kerosene torches and often by electric flood lights.

Money for Roads

How would revocation of 1939 federal aid affect roadbuilding? An answer from the record focuses attention on the future normal program.

THE President's proposal to revoke the 1939 federal-aid authorization and to fix subsequent authorizations at a "normal" figure has raised many doubts in the circles of highway engineers and officials. What does the proposal mean for roadbuilding? Discussions of the question have revealed much confusion, even to the extent of fear that road improvement would be stopped for a year. The record of past performances goes a long way toward clearing up the confusion.

The graphic record

Official figures of federal-aid authorizations and expenditures, shown graphically in the adjoining chart, prove that there is little direct relation between expenditure and authorizations. Long-time totals agree, of course; thus, from the beginning of federal aid in 1917 to June, 1937, the authorized expenditures sum up to $2,740,000,000, while the total expenditures over the same period are $2,423,257,648. But individual years do not match in this way; even a large increase or reduction in authorization for any one year is not duplicated in expenditure.

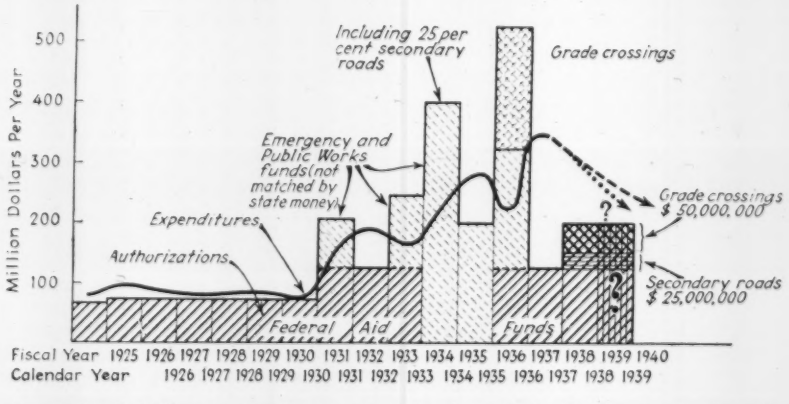
Striking examples are the reductions in 1932 and 1933 from emergency extras authorized for the years directly preceding; in both instances actual expenditures were higher in the reduced years than in the preceding or following year. Again, the 125 million dollar road fund authorization for 1937, lowest in five years, contrasts with a record high of expenditure, $343½ millions.

This is due to the extensive distributing effect of federal-aid working procedure, well known to all road men. The federal-aid system, of course, is geared to the necessities of joint legislative action by Congress and the states: Congress authorizes the federal-aid funds for two years at a time, about a year before the first of the two years. Months afterward the Secretary of Agriculture announces the apportionment of the first year's funds to the different states, which the law requires him to do before Jan. 1. This early apportionment has the effect of fitting the authorization to the construction year, as necessitated by normal construction procedure. The states having in the meantime made appropriations for their respective contributions to the joint work, their highway departments plan construction projects, submit them for approval by the Bureau of Public Roads, and let contracts, later receiving reimbursement for the payments made.

The large lag involved in this chain of operations is apparent. But in addition the money is distributed over a much longer period because of the provision of law by which each year's authorization remains available to the states during two years (recently only one) after the close of the fiscal year for which it was authorized. The lag in actual expenditures is further increased by several months due to the fact that the states make the initial payments to contractors, later billing the federal government for its pro rata share.

A specific case is represented by the $200,000,000 authorization for fiscal year 1938 (July 1, 1937, to June 30, 1938). Of the 200 million dollars only 15 million dollars has been appropriated for expenditure prior to next July, while 185 million remains to be appropriated during the two following fiscal years. Of this balance, normally a little more than half (about 100 million dollars) would be required for actual payments during fiscal year 1939, the remainder going over to the following year. The appropriation recommended in the President's message provides for just this distribution.

Revocation of the 1939 fund of 200 million dollars, as proposed by the President, is represented in the chart by vertical hatching. Should Congress adopt the proposal, its probable effect on actual road construction and expenditures is indicated by the dotted line, somewhat below the dash line representing the expenditures that are likely to be made if the revocation is not carried out. Work during the fiscal year 1938 would be substantially unaffected, al-


Million Dollars Per Year
500
400
300
200
100
Including 25 per cent secondary roads
Grade crossings
Emergency and Public Works funds (not matched by state money)
Expenditures
Authorizations
Grade crossings $ 50,000,000
Secondary roads $ 25,000,000
Federal Aid Funds
Fiscal Year 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940
Calendar Year 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939

How federal highway expenditures are related to authorizations, and what the proposed road cut would do.

though operations in the fall of 1938, which is the first half of fiscal year 1939, would be reduced. A considerably heavier reduction would occur in the spring of the calendar year 1939. But by this time the 1940 money (to be authorized by Congress a few months from now) would be available.

The net effect of the proposed reduction, in brief, is not a sudden interruption of roadbuilding but merely a more rapid return from the expenditure peak. Although this is true of the total program, eight or ten states that already have substantially taken up their 1938 funds would experience a sharp reduction in their federal-aid program, since new projects could not be started until the 1940 funds became available Jan. 1, 1939. For example, Michigan has already absorbed 97 per cent of its 1938 apportionment, and would be able to do little work next fall if the revocation should be enacted.

What is the future "Normal"?

The second vital question raised by the President's message relates to the amount of this future "normal." The message suggested the figure of 125 million dollars. But it will be remembered that the Hayden-Cartwright Act passed in June 1936 provided for 50 million dollars of grade-crossing work and 25 million dollars of secondary-road construction in each of the fiscal years 1938 and 1939, in addition to funds of 125 million dollars for federal-aid roads—the main trunk roads. If the future total is to be set at 125 million, either federal aid would have to be heavily reduced or grade crossings and secondary roads would have to be curtailed.

The chart brings out clearly the relation between the maintained 75-million-dollar federal-aid authorizations of the '20s and the present 125-million-dollar level (after excluding grade-crossing and secondary-road items). Road travel has increased during the ten-year period by practically 100 per cent, and demands for full development of the main routes have increased correspondingly. It may be expected that this fact will be duly considered by Congress when it has to decide on the proper figure at which to level out from the high emergency expenditures of the past seven years.

FIG. 1. NEW TRESTLE TYPE BRIDGE OVER COLORADO RIVER AT PARKER, ARIZONA.

Armored Steel Trestle

Flood control by Boulder Dam makes possible new low-cost crossing near Parker Dam

THE FIRST permanent bridge of the trestle type to be constructed on the lower reaches of the Colorado River has recently been completed below Parker Dam at a cost much less than would have been necessary heretofore for a highway bridge in this location. Flood storage by Boulder Dam has decreased the maximum flood in the Colorado (above the mouth of the Gila) from 200,000 sec.-ft. to a released flow of about 75,000 sec.-ft. as a maximum. Parker Dam will somewhat regulate the flood runoff from the Bill Williams River, the only tributary between Boulder and Parker.

Foundation conditions are bad along the lower Colorado and so long as floods were to be expected good design called for deeply founded piers that would avoid scour dangers. Because such piers are costly, long spans were necessary and bridge costs were so high that relatively few highway crossings were made. The new situation of controlled floods and consequently lower foundations costs was a factor in the decision to build a highway bridge 14 mi. downstream from Parker Dam at the little town of Parker, Ariz., where an interstate link has been needed for some time.

The Parker bridge connects Arizona State Highway 72 with the Metropolitan Water District's road on the California side of the river, thus giving Central Arizona points access to Parker Dam and a shorter route to Boulder Dam than the present one via Ash Fork. The Parker bridge is about 50 mi. below the Topock highway bridge (U. S. 66) which is the nearest permanent bridge upstream, and the same distance from the Blythe bridge (U. S. 60), next below. The latter crossing, built in 1927, has five 188-ft. spans and prior to this year these were the shortest spans on the river. In sharp contrast with 188-ft. spans the new Parker bridge is an inexpensive trestle with ten 63-ft. spans of steel *I*-beams on piles.

Channel conditions

The controlled flow of 75,000 sec.-ft. requires a channel only 600 ft. wide instead of more than 1,400 ft. that was provided in the Santa Fe Ry. bridge, built in 1908, only 190 ft. upstream from the site of the highway bridge at Parker. The Santa Fe bridge has five 288-ft. spans supported on concrete piers of which four are set in gravel and boulders 50 to 93 ft. below streambed.

Because of the relatively narrow channel width now required, one abutment of the new bridge was placed on stable material on the Arizona bank; the other was built near

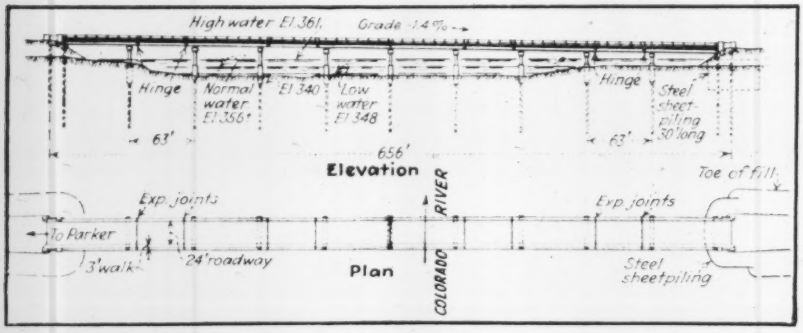


Fig. 2. Span arrangement showing cantilever and suspended portions

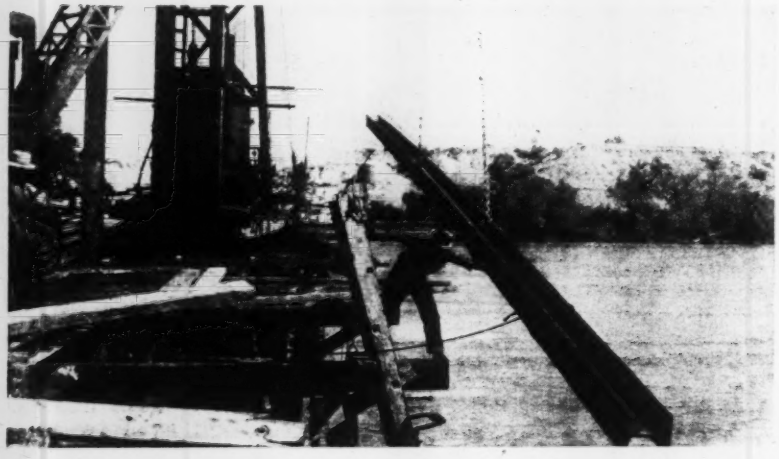


Fig. 3. Handling 12-in. steel bearing piles 80 ft. long.

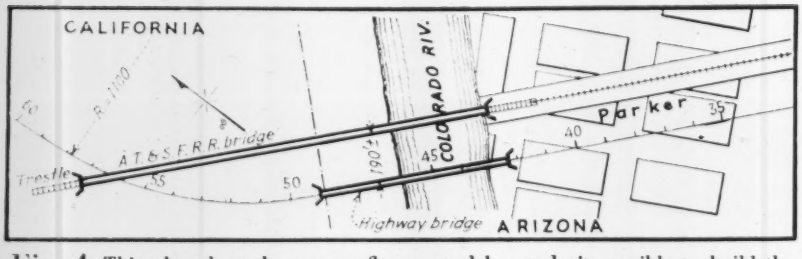


Fig. 4. This plan shows how streamflow control has made it possible to build the highway bridge much shorter than the older Santa Fe Ry. bridge.

the middle of the old channel and is reached by a roadway approach fill some 800 ft. long extending out from the California bank. This fill is from 10 to 18 ft. in depth and although the river bed consists of silt about 15 ft. deep, the fill has shown practically no settlement. This fill approaches the bridge beneath the westerly railroad bridge span thereby eliminating a grade crossing.

The new bridge is supported on pile bents in each of which are eight steel piles consisting of 12-in., 74-lb. *H*-columns. The piles were delivered to the job in 80-ft. lengths and were driven 50 to 60 ft. below streambed; the depth of the driving was based on a study of the logs kept when the nearby railroad bridge piers were put down. The expected penetration was obtained quite generally in driving the steel piles and the bearing capacity, based on the *Engineering News* formula, ranged from 50 to 100 tons. The design load per pile is 40 tons.

A static load test was made on one of the piles near the center of the bridge by using a hydraulic jack bearing against an *I*-beam anchored to two adjacent piles. With this device an 80-ton load was applied for 48 hours and the load then was increased to 100 tons for a short period without causing any settlement. The adjacent piles withstood the 50-ton uplift without yielding.

To handle the long piles a falsework deck was built 25 ft. above streambed and from this the contractor handled the steel piles with a crane lowering them to position and jetting them through 15 ft. of silt and another 10 ft. of sand. After being put down this far it was possible to bring in a driver rig mounted on skids, with 40-ft. loads and to get the hammer over the steel pile. The piles then were driven on down 30 to 35 ft. into sand and gravel of the river bed. An aid in this driving was a jet from a 6-in. centrifugal pump driven by a 200-hp. gasoline motor delivering water at a pressure of about 125 lb. per sq. in. The driving was done with a double-action steam hammer delivering a blow of 15,000 ft.-lb.

To give protection from rust, specifications required encasement of the steel piles with concrete above a level 3 ft. below streambed. From this point to ordinary water level the encasement required was a concrete cylinder 24 in. in diameter, poured as tremie concrete in a steel shell; the shell to be removable or left in place at the option of the contractor.

Pile forms

The contractor elected to use as forms removable shells 22 ft. long made up of two halves hinged together longitudinally and with two sets of transverse bars welded into the shell at top and bottom for centering the form around the pile. Such a shell was lowered over each pile and jetted to grade after which the silt was forced out by operation of the jet and concrete was placed with tremies. After the concrete had set, the hinge rod was pulled, loosening the two halves of the cylinder which then were swung apart, lifted out by the crane and laid aside awaiting re-use.

Above the steel shell, square concrete encasement was used to facilitate easy forming. This also permitted use of a diaphragm 6 ft. deep (Fig. 1) between the several piles of each bent to give lateral stiffness and to reduce danger that might arise if drift could lodge between the piles.

The concrete cap carries the superstructure loads into the steel piles through 14-in. square steel bearing plates welded to the tops of the piles.

Between the bents, which are 63 ft. on centers, the roadway is supported on 36-in. steel I-beams of which four are used spaced on 8-ft. centers. The concrete floor slab is 24 ft. wide and there is one 3-ft. sidewalk cantilevered therefrom. The maximum moment in the steel beams was reduced below that of a simple span by cantilevering the beams in alternate panels 8 ft. beyond supports. The ends of these cantilever beams have links in which are hung the beams of 46-ft. suspended spans. In this way, the weight of the inside beams was kept down to 170 lb. per ft. and the outside beams to 150 lb. for the standard 15-ton truck loading.

Each abutment consists of a concrete deck resting on two transverse rows of steel piles with the roadway approach fills occupying the space beneath the deck. On the Arizona abutment the fill will be entirely above high water; on the California side it will be submerged at times of maximum flow. For protection against erosion the low fill is faced with a U-shaped bulkhead of 30-ft. steel sheetpiles and the two sides of the bulkhead are tied together by steel cables running through the fill. To prevent scour, wire baskets filled with riprap were placed around the bulkhead at the level of streambed.

Cost of the new bridge, including bulkheads and riprap, was about $115,000. Grading the two approaches cost $24,000 additional. The survey, plans, construction and engineering were financed largely by federal land funds allotted to the two states by reason of the fact the bridge is in the Colorado River Indian reservation.

Design and construction was under the direction of the U. S. Bureau of Public Roads; C. H. Sweetser is district engineer; George D. Whittle is bridge engineer, and Harry P. Hart was resident engineer on the Parker Bridge job. Contract for building the bridge was held by the Wickes Engineering & Construction Co. of Des Moines, Iowa.

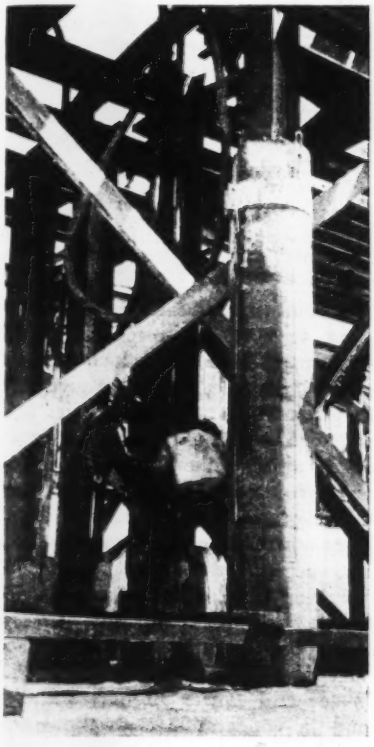


Fig. 3. Washing silt from inside of collapsible steel form around the pile prior to pouring the tremie concrete encasement. At the right a steel shell around another pile is ready to be jetted to place.

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Mexico Builds Railways

FIVE RAILROADS are now under construction in Mexico. Four are being built by the government, the longest of which is the southeastern line, 500 miles long, which runs from Puerto Mexico, Vera Cruz state, to Campeche City, capital of Campeche state. A second line runs from Calzontizin, Michoacan state, to Zihuatanejo on the Pacific Ocean in Guerrero state. Also under construction are lines from Fuentes Brotantes to Punta Penasco, both in Lower California Territory, and from Ixcaquixtla to Chacahua Bay, on the Pacific Coast in Oaxaca state.

A private line 22 miles long is being built between Altotonga and the Gulf of Mexico port of Perote in Vera Cruz state. Consideration is being given by the Mexican government to the possibility of completing two lines that were started some time ago by private concerns but were abandoned for financial reasons. These lines are a shortcut railroad between Mexico City and Tampico, which the National Railways of Mexico dropped after completing 56 miles, and one between Durango City and Aserradeo in Durango state. Completion of the latter line, it is estimated will cost about $5,600,000.

Mexico City, Mex.—Five railroads are being built in Mexico, four by the government and one by a company of workingmen. Railroads the administration is constructing are:

The southeastern, terminals of which are *Puerto Mexico, Vera Cruz* state, and *Campeche City*, capital of *Campeche* state, a route of some 800 kilometers; *Calzonitizin, Michoacan* state, to *Zihuatanejo*, a Pacific port in *Guerrero* state; *Fuentes Brotantes* to *Punta Peñasco*, Lower California Territory, and *Ixcaquixtla, Puebla* state, to *Chacahua Bay*, on the west coast of *Oaxaca* state.

The Mexican government is considering propositions for resuming work on and pushing to completion two railroads that were started by private enterprises but more or less abandoned for various reasons, mostly financial. These lines are the short cut railroad between Mexico City and Tampico which the National Railways of Mexico dropped after completing 90 kilometers of it, and that between Durango City and Aserradeo, Durango state. The government estimates that 20,000,000 pesos (approximately $5,600,000) will be necessary to complete the latter railroad and extend it to one of western Mexico's best outlets, Mazatlan, an important Pacific port.

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C. N. R. Completes its Line In Northern Quebec

THE Canadian National Railway officially opened a new branch line from Senneterre to Val D'Or in Northwestern Quebec November 29. This is the first piece of new railroad construction completed in Canada for several years. It will provide the newly developed mining area in that region with an outlet to the Transcontinental line of the C.N.R.

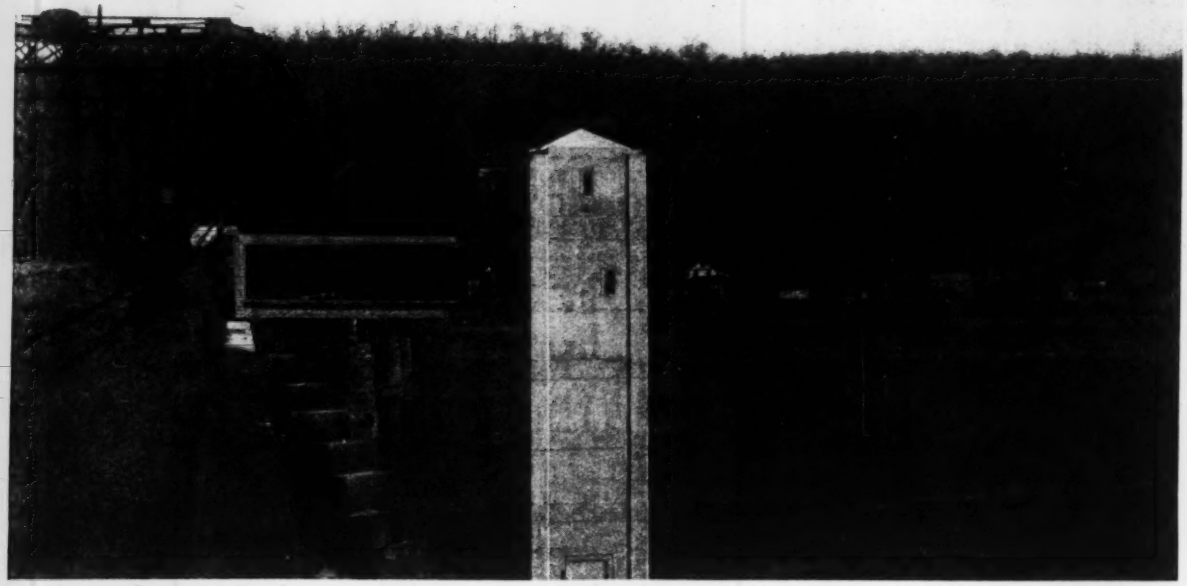

FIG. 1. COOPERATIVE GAGING STATION ON THE ALLEGHENY RIVER AT FRANKLIN, PA.

Modernizing Headwater Forecasting

by MERRILL M. BERNARD

Chief, River and Flood Division, U. S. Weather Bureau, Washington, D. C.

Cooperative work in Pennsylvania points the way toward getting better advance warning of unusual floods from sources controlled by several agencies

DISASTROUS FLOODS in New England in 1927, in southern New York and Pennsylvania in 1935, and over the whole of the North Atlantic drainage area in 1936, resulted in quickening flood consciousness in headwater areas of our larger rivers and in many important smaller basins. With the consciousness came also recognition of the fact that responsibility for providing flood warnings in headwater areas is not fixed as it is farther down on the larger rivers.

Federal responsibility for providing flood forecasting service for those occupying the flood plains of the nation's larger rivers was recognized nearly 70 years ago. An appropriation bill passed in 1871 specifically required that river-stage observations be added to the meteorological observations taken at various military stations. The 1890 Act of Congress transferring the meteorological work of the Signal Office to the Weather Bureau of the Department of Agriculture charged the bureau with the responsibility of "issuing storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce and navigation; the gaging and reporting of rivers."

The ensuing period was marked by an enviable record of service throughout the greater length of the Ohio and Mississippi rivers, and on many important smaller streams. Approaching floods have been announced with consistent accuracy at all principal cities, making possible the orderly evacuation that distinguished the more recent great floods.

However, responsibility for flood forecasting shifts in varying degrees to other interests as headwaters are approached and as problems become more and more localized. This transition in economic responsibility is accompanied by marked changes in method. Thus levee systems give way to combinations with reservoirs and organized land-use practices over large areas. Likewise, methods of river forecasting which have successfully met the conditions of lower river flow must be elaborated to take into account the many factors influencing smaller steamflow.

The Commonwealth of Pennsylvania has been among the first to recognize this trend. Through its Water and Power Resources Board and in cooperation with the U. S. Weather Bureau and the U. S. Geological Survey the means have been provided to establish a modern forecasting service on the Allegheny, Monongahela, Susquehanna, and Delaware rivers. Plans for the service are in many respects unique.

Modern methods of estimating streamflow from rainfall extend the analysis into the relatively small watersheds comprising the river basin. The procedure involves short concentration periods, and rainfall rates of short duration and high intensity. Obviously, rainfall rates recorded as averages for 24 hours cannot be used in studies on watersheds of 50 to 500 sq. mi. having concentration periods of 2 to 6 hours. Therefore, the first step in the program has been to establish over the river basins comprising the project a net of approximately 130 recording rain gages having an average density of 400 sq. mi. per gage. The locations of the recording rainfall stations are shown in Fig. 2, and a typical installation is shown in Fig. 3.

It is interesting to note that, including the 500 recording rainfall stations recently established on the Muskingum watershed, there is a continuous net of closely spaced recording rain gages covering the greatest area so served in this country. This net, if extended west to include the Scioto and Miami conservancy districts, would insure a record of short-time rainfall north of the Ohio River over the whole region from the Delaware River into Indiana.

Gathering precipitation data

The deficiency in short-duration rainfall data also exists in the commonwealth's records of streamflow which are gathered cooperatively with the U. S. Geological Survey. The plan provides for the installation of approximately 15 additional streamflow stations of the recording type. A typical river gaging station is shown in Fig. 1.

The recording rainfall stations have been classified as (1) those which are located primarily to serve the hydrologic studies from which forecasting methods are to be developed, and (2) those which are to serve ultimately as reporting rainfall stations under the established forecasting procedure. Stations in the first group have been so located as to give proper weight to geographic position in the net, area served, elevation and aspect, without providing for local attendance. Those in the second group have been located at strategic points where qualified 24-hour attendance is available and dependable communication assured.

Practically all rainfall stations are accessible over paved highways and have been located on three circuits over which experienced hydrologic engineers will travel on schedule. These engineers will be charged

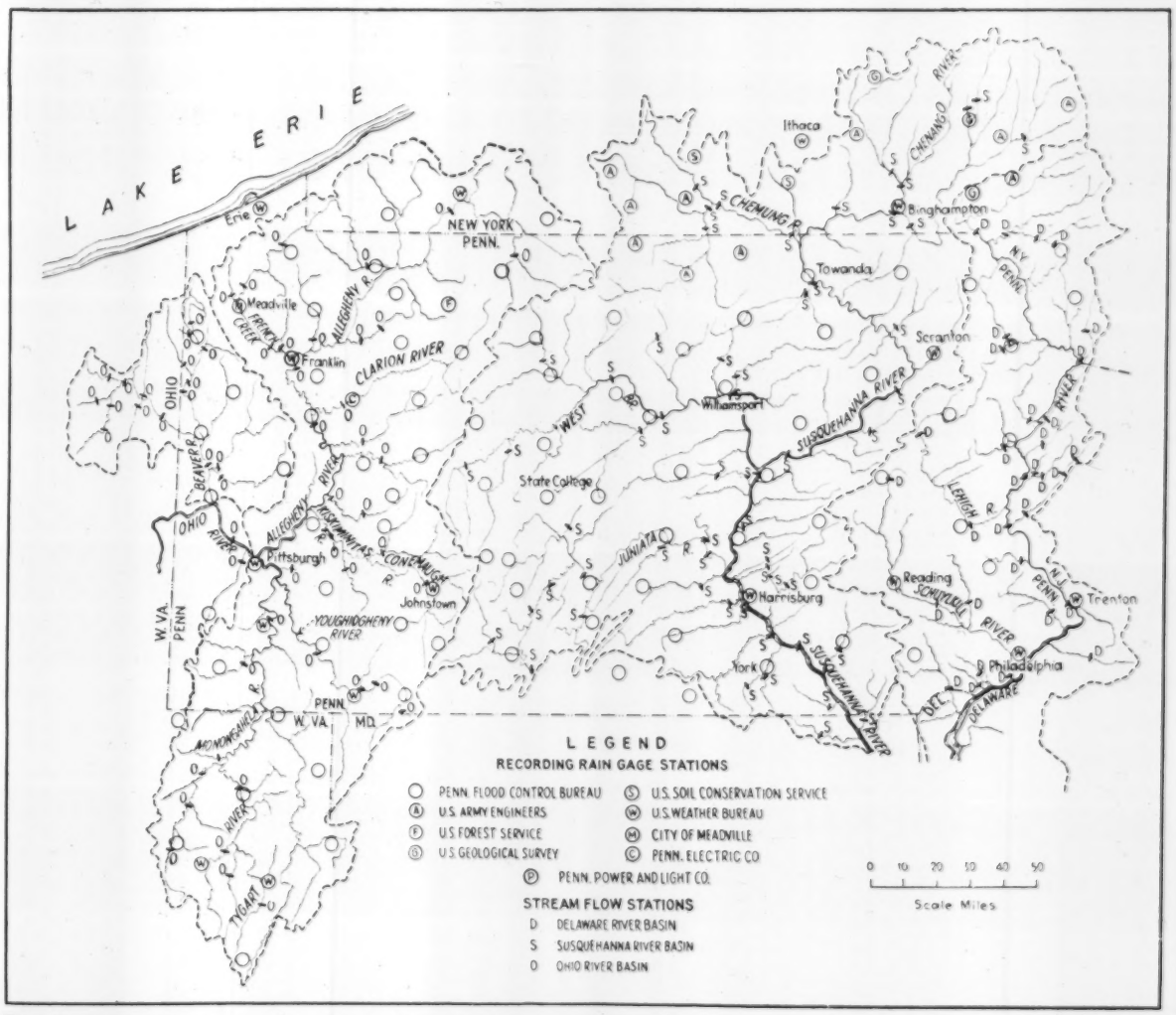

Fig. 2. Rain and stream gage stations in Pennsylvania that are operated on a cooperative basis in the interests of better flood forecasting.

with the duties of attending the gages, assembling the charts and tabulating the data for immediate use. During the winter months they will conduct snow surveys and keep informed of day by day changes in run-off conditions.

An acceptable method of headwater flood forecasting must produce the synthesized flood hydrograph promptly from factors which are constant, readily anticipated or determinable in the early stages of a flood storm. Under conditions in Pennsylvania where flow concentrations and therefore forecasting periods are measured in hours and not days a forecast to be effective must begin literally with rainfall. Recently developed methods of estimating streamflow from rainfall, of which the unit-hydrograph method seems to offer the greatest utility, will be applied immediately within the limits of existing data. Within a short time it is expected that a sufficient number of storm experiences will have been recorded to carry the hydrologic study into the smaller watersheds.

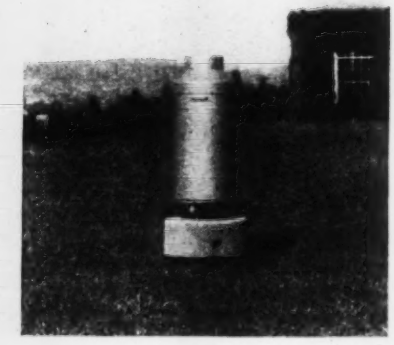

Fig. 3. Low-cost recording gage that has facilitated maintenance of isolated stations.

It has been found that the discharge from a relatively small watershed may be an index to surface conditions over much larger areas. Small basins having this characteristic will be equipped with automatic stage recorders and facilities set up to transmit the record of flow promptly to the forecasting centers. Thus the "index" watersheds will provide, in the early hours of a storm, an indication of what its actual run-off coefficient is to be.

Procedure at a typical forecasting center will in general be as follows:

(a) A day-by-day estimate of runoff potentialities based upon the discharge from index watersheds, the estimate to include the possible contribution to runoff from an existing snow mantle.

(b) A day-by-day check on storm approach, utilizing the more practical phases of air mass analysis.

(c) With the beginning of a critical storm period, the reception of hourly (or other-period) rainfall by telephone and telegraph, or by amateur and automatic radio broadcasting.

(d) The preparation of an isohyetal map showing the progressive accumulation of rainfall depth over the basin.

(e) Under a well organized and largely mechanical technique, the conversion of rainfall into streamflow hydrographs.

(f) The propagation of the flood wave, as tributary flows combine throughout the length of the principal channels.

(g) The conversion of rates of streamflow to river stage at points downstream for which a forecasting service is rendered.

(h) As quickly as rainfall has ceased, the prompt announcement, through established channels, of flood peak stage and the hour of the arrival of the storm's crest.

The project has the full support and cooperation of the Corps of Engineers, Forest and Park services, and the Soil Conservation Service. Furthermore, it promises to set a new standard of cooperation between federal and private agencies. The utilities companies operating in the area have organized themselves to render a most effective service in making available for the transmission of data their dispatching and communication facilities. Many of the rainfall stations are located at their field stations where qualified attendance has been made available. One company, at its own expense, has assisted in organizing a "second line of defense" by determining the elevation of such objects as will survive the loss or damage of the official gages along the Susquehanna River. The elevations are recorded on photographs to be distributed among those charged with the responsibility of assembling data during the course of a flood.

The success of a method of forecasting capable of predetermining flood crest elevation sufficiently far in advance to provide adequate time for exacuation will depend largely on the organization of facilities for assembling data. This is particularly true at a point such as Pittsburgh where property values are high and almost any cost is justified in adding an hour to the forecast period. All methods of transmission are being given serious study; while wire communication is least dependable during intense storms, immediate use will be made of wire facilities.

Recent developments in transmitting equipment are timely and will be used to bring to the forecasting centers data from remote index stations. Of particular interest is a newly developed telephonic stage transmitter which utilizes a standard telephone and can be operated through any public exchange. A device actuated by the ringing circuit raises the receiver of the telephone throughout a period sufficiently long to encompass the cycle of stage signals. The time lapse in seconds between signals, divided by a constant, gives the stage in hundredths of a foot.

As an example of the possibilities of this type of device in providing almost instantaneous information on river stages at points far removed, an installation of a telephonic stage transmitter on the Potomac River at Washington may be cited. That gage can now be read from any telephone in the country—provided of course the person making the call knows how to interpret the signals received. He simply calls a certain telephone number in the usual way. The circuit is automatically held open for 6 min., during which he uses a stopwatch to time the interval between audible signals. Dividing the time, in seconds, by a constant gives the gage height to hundredths of a foot. Thus an experienced operator, even though in California, can quickly learn the stage of the Potomac River.

Radio transmission promises in time to overcome the hazard of wire line failure. Automatic radio stage transmitters are being operated successfully by the U. S. Geological Survey and the Tennessee Valley Authority, the latter also resorting to radio to transmit rainfall depths from remote stations.

The utilization of amateur radio broadcasters in the transmission of forecasting data will be considered. It is believed, however, that the amateur will make his real contribution during emergencies in safeguarding forecasting operations against the failure of other communications.

Data from Road Research

Notes from papers presented at Highway Research meeting on subgrades, pavement, vehicle operation, safety and related matters

OBSERVATIONS and facts on many features of road design operation and maintenance were presented in the papers submitted to the Highway Research Board held at its Washington meeting last week (Nov. 30 to Dec. 3). Notes on those contributions having most general engineering interest are given below in the form of brief abstracts, supplementing the general report of the proceedings published last week (*ENR*, Dec. 2 1937, p. 918).

Of the outstanding subjects, soils, roadsides and safety were represented largely by progress reports or preliminary work rather than by definite new facts. On the other hand, specific data were given on road design, the relation of vehicle to road, subgrades, pavements and maintenance.

Road design

Modern Road Cross-Sections—During the past five or six years the cross-sections of roads have been progressively changed by flattening the steep slopes, narrow ditches and sharply rounded shoulders of former years. Leading motives are the need for better shoulders, the effort to reduce slope erosion and cheapen maintenance, control of grass and provision for future sidewalks.—W. H. SIMONSON, *U. S. Bureau of Public Roads, Washington.*

Speed and Road Design—Giving all due consideration to the future, it hardly seems that there is any reason for assuming higher rates of speed than 50 to 60 m.p.h. in the design of any road, and even lower speeds than this in difficult terrain. —F. LAVIS, *consulting engineer, New York City.*

Observed Speeds—Traffic on four sections of road in Michigan (pavement, two treated gravel, one loose gravel) was measured by photographic methods in cooperation with Prof. R. S. Swinton in 1933. Average daily traffic ranged from 402 to 1384 vehicles. Passenger cars averaged 47.85 m.p.h. on pavement, 43.27 m.p.h. on pavement, 43.27 m.p.h. and 37.10 m.p.h. on treated surface, and 32.56 m.p.h. on the loose gravel. Truck speeds were 37.94, 32.50, 30.19, and 28.2 m.p.h. —PROF. B. D. GREENSHIELDS, *College of the City of New York, New York City.*

Vehicle and road

Tire Pressure Distribution—By an ingenious new test method the distribution of pressure between tire and road surface was measured for a solid and a smooth tread pneumatic (airplane). A 5/16-in. square brass bar and filler plates of precisely the same thickness were placed between a smoothly ground bed plate and a sheet of polished shim stock on which the tire bore. The tire being pressed down on this test assemblage by a known testing machine load, the force required to pull out the square brass bar was measured by a spring scale dynamometer.

The results, shown by adjoining sketches (Fig. 1) indicate a distribution more nearly ellipsoidal than uniform, though in both instances a small area of high pressure was observed near either edge of the bearing area.—L. W. TELLER and J. A. BUCHANAN, *U. S. Bureau of Public Roads, Washington.*

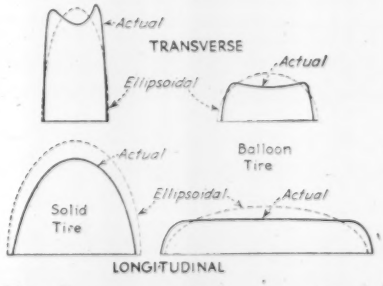

Fig. 1. TIRE PRESSURE is not uniformly distributed.

Pavement Friction Machine—Because cast-iron pavement plates are used on some roads at the University of Minnesota it was desired to find what design of corrugations would give best frictional resistance. A testing machine was built in which an automobile has its front wheels bearing on two fly wheels 6 ft. in diameter on the periphery of which are fastened the pavement plates under test. The two flywheels are brought up to speed by a motor, the motor is shut off and the car brake applied, after which the slowing down of the wheel is observed and at the same time the tractive pull on the car is measured by a dynamometer.

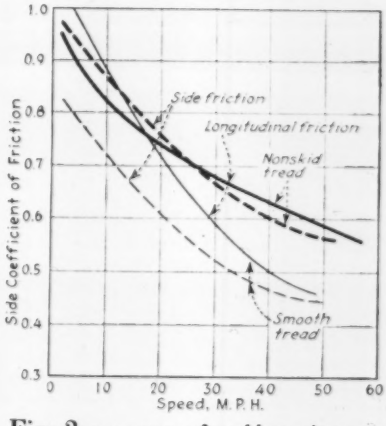

Fig. 2. FRICTION of rubber tires on cast-iron pavement plates decreases with speed.

The results showed that the friction coefficients of the cast iron paving could be doubled by suitable design of the corrugations. At 30 m.p.h. initial speed, with wet surface, the extreme values obtained with smooth tires were: for impend-

ing skid, 0.32 min., 0.86 max.; for wheels locked, 0.24 and 0.66; for side friction, 0.48 and 0.75. Slightly higher values were obtained with non-skid tires. Friction coefficients varied with speed as shown (Fig. 2). —D. E. HANSON, *University of Minnesota, Minneapolis.*

Automobile Operating Costs—Data on car operation supplied for 160 cars by rural mail carriers in Iowa and Indiana showed average year-round operating costs of 8 cents per mile on earth, 5 cents on gravel, and 3½ cents on pavement. Summer costs were lower than winter costs by 2¼ cents, 1¾ cents, and 1 cent respectively. The cost of gasoline, oil, tires and maintenance alone averaged 3.07 cents per mile on earth, 2.17 cents on gravel, and 1.44 cents on pavement.—PROF. R. A. MOYER, *Iowa State College, Ames, Iowa.*

Curving Power of Cars—Tests for curving power were made at General Motors' proving grounds on practically all makes of cars by running them on a slab built on a circle of 103 ft. radius. A rubber-tired wheel rolling along a pavement and pushed sidewise against its hub would require under ideal conditions about 100 lb. of side force to deflect its course one degree; thus when there is a side force of 100 lb., the wheel must be steered one degree toward the force to maintain its course. This angle is known as the slip angle. When side forces are encountered the driver must steer toward the side from which the force is coming until the tires have enough slip angle to balance the force. A car in which the front end has more slip angle than the rear requires a greater steering angle than one in which the slip angles are equal; this car is said to be understeering.

Steering angle and wheel angle were measured, the former by sighting with a transit on a pole set at the center of the track circle, the latter by direct indication from the front axle. Results on an oversteering and an understeering car are shown (Fig. 3). Car *A*, which is understeering, requires only 8½ in. extra width of lane at 30 m.p.h., while car *E*, with wheelbase 10 in. shorter, requires a lane 17 in. wider than its body. An understeering car also is safer. When the cornering ratio (ratio of side force to weight of car) reaches 50 per cent the tire has started side skidding, making the behavior of the car erratic.—MERRITT L. FOX, *General Motors Proving Ground.*

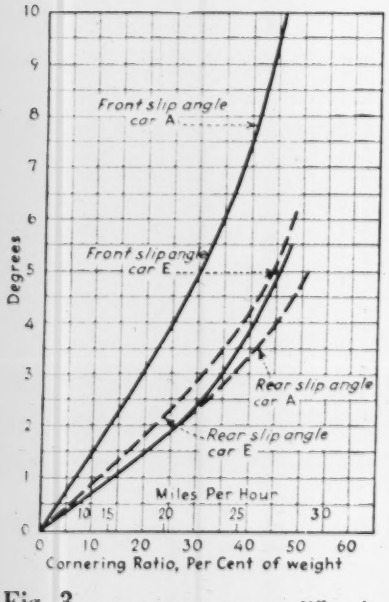
Front slip angle car A
Front slip angle car E
Rear slip angle car A
Rear slip angle car E
Miles Per Hour
10 15 20 25 30
Degrees
0 1 2 3 4 5 6 7 8 9 10
0 10 20 30 40 50 60
Cornering Ratio, Per Cent of weight

Fig. 3. WHEEL SLIP ANGLES differ in different cars.

Soil stabilization

Bituminous Stabilization—Stabilizing sand with bituminous material began in Florida about seven years ago. Poor grading of the sand caused no trouble if the shape of the particles was satisfactory. On one project, where the mixture was not sufficiently stable to carry traffic, it was found that not only was 200 mesh material practically absent but the particle shape was round instead of angular. It is best to stabilize such material with fine material before adding the bitumen.

Bituminous material is added in successive applications of about 0.35 gal. per sq.yd., and mixing is done by tractor-drawn harrows and graders which windrow the material from one side to the other until a uniform mix is obtained. In order to obtain a 6-in. compacted thickness, it is necessary to work about 9 in. loose. The first 3 in. is partially mixed and windrowed to each shoulder; the lower half of the slab is then mixed, and when finished the windrowed material is pulled back in place with the grader and mixing continued until completed. The top layer requires somewhat more bituminous material. After final mixing, the material is shaped to proper cross section, compacted with rollers and lightly bladed or scraped.

Where the mixing was done with graders it was found difficult to mix on cool days, and after rains a delay was necessary to permit the material to dry. A "hot blade" has recently been invented which promises to eliminate these difficulties. It consists of a metal oven bolted to the back of the grader blade which diffuses the flame of three burners to the blade and produces a temperature of about 300 deg. F. at the face of the blade.

Either cutback asphalt or tar may be used, in quantities from 3½ to 7 gal. per sq.yd. For subgrades the quantity is reduced generally to about 1½ gal. per sq.yd.

About 325 miles of this pavement, some of which has been surface treated, is satisfactorily carrying traffic at very low maintenance. The cost ranges from 40c. to 90c. per sq.yd. —H. C. WEATHERS, *Florida State Road Department, Tallahassee.*

Cement Stabilization—Five states, Illinois, Iowa, Michigan, Missouri and Wisconsin, have built test sections of cement-stabilized soil road during the past year, most of it 6 in. Road-mix methods using disk harrows, quack grass diggers or road machines were used generally, in a few cases a traveling mixing plant. The mixture was compacted with sheepsfoot rollers at optimum moisture content, bladed, and loose material compacted with rollers. Shrinkage cracking occurred in spite of curing, where used. A bituminous wearing surface was applied to most of the sections because of scaling and irregularities.

Illinois used 10 per cent by volume. The surface was scarified and pulverized in advance; mixing the cement with the soil was done by disk harrows supplemented by blading. Water was added in two lifts, and compaction was done with sheepsfoot rollers. Some sections were cured for seven days, but in all cases transverse cracks and some hair checking developed a few days after completion. The total cost exclusive of cement was 28c. per sq.yd.

Iowa in 1937 built 1.6 mi. of 4-in. base of soil and gravel containing

about 15 per cent clay; cement 10 per cent by weight. Cement was spread in two layers over the pulverized soil by a spreader attached to the rear of a truck, and mixed by quack grass diggers. The completed base, which cost 39c. was primed with tar, and later a bituminous wearing surface was added. Michigan found that density tests gave an accurate check on grading of the material, and that a cement-voids ratio of 15 per cent produced a durable mixture. Very sandy soil was improved by adding clay. Scaling and disintegration subsequently developed in spots, in one year of weathering with practically no traffic on the road.

Missouri built a 1½ miles section in 1936, with 6 in. thickness, using 12 per cent by compacted volume. The completed surface was protected by straw. Some surface scaling developed, especially at the construction turn-arounds. Later a bituminous surface was added to give good riding quality. In a 2-mile section built in 1937, part was done by road mix and part by a traveling mixing plant, using 6 to 8 per cent cement. A 5-mile section was built late in 1937, in soil ranging from 14 to 28 per cent clay and with parts of an oil mat surface included; results are not yet at hand. The cost of the several sections so far built ranges from 15c. to 34c. per sq.yd.

On some 3 miles of road built in Wisconsin in 1936 and 1937 the sand was so uniform that even 20 per cent cement was insufficient, and finally 20 per cent clay and 8 to 10 per cent cement were used. In compacting with sheepsfoot rollers correct moisture content was very important, as with 9.3 per cent moisture the soil was crumbly, with 10 to 11 per cent the compaction was good, and with 12.3 per cent the material was spongy and tended to peel.

On 10 miles of cement stabilized road of sand clay loam in South Carolina last winter, 8 to 10 per cent of cement was used; the bid price was 49½c. per sq.yd.—W. H. MILLS, *South Carolina highway department, Columbia.*

Concrete pavement

Early Heat Liberation of Cement—In studying early heat liberation of cement by use of several forms of special calorimeter, it was found that normal portland cements differ greatly among themselves and differ still more from special types of cement. The latter effect is shown in Fig. 4. Fine grinding increased the maximum rate of heat liberation. Cements with high tricalcium aluminate attained higher rates of heating than others. Additions of gypsum had variable effect, the highest rate being obtained with 1.5 per cent.

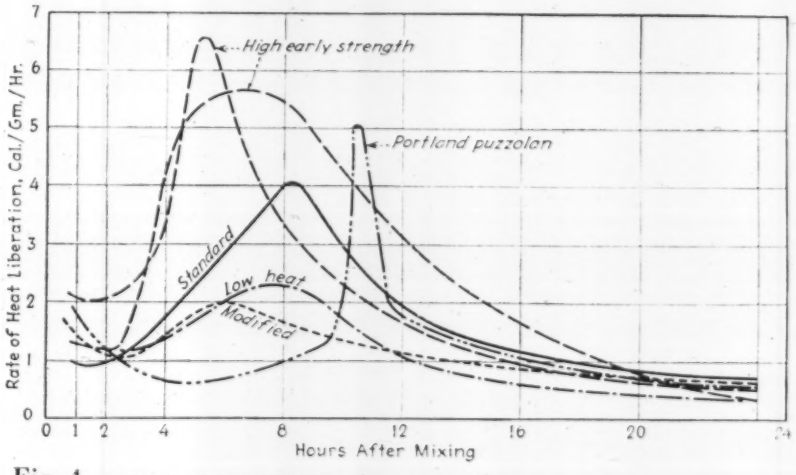

Fig. 4. EARLY HEAT OF CEMENTS varies over a wide range.

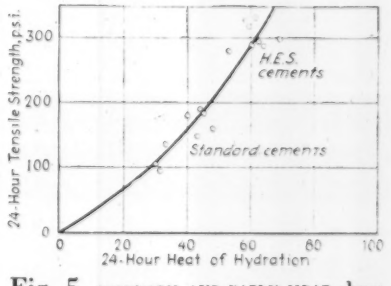

Fig. 5. STRENGTH AND EARLY HEAT show fairly close relation.

The mortar strength of the cement proved to be roughly proportional to the total 24 hr. heat liberation (Fig. 5). Shrinkage cracking of concrete pavement during the first day after construction may be due to excessive early heating. As Fig. 6 shows, some cements may produce a temperature rise of more than 30 deg. in a 10 in. pavement slab, as computed.—PROF. R. W. CARLSON, *Massachusetts Institute of Technology, Cambridge.*

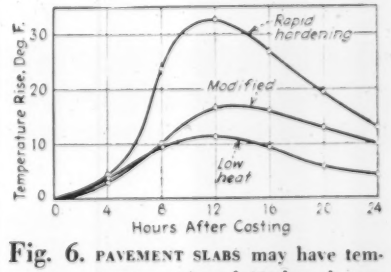

Fig. 6. PAVEMENT SLABS may have temperature rise of 30 deg. due to early heat of cement.

Corner Stresses in Slabs—Corner stresses in a 6-in. concrete slab 12x12 ft. built on clay subgrade were measured at Iowa State College. Load was applied on a circular area close to the corner by a testing machine; subgrade pressures were measured by Goldbeck cells, slab deflections were measured directly, and stresses in the top of the slab were calculated from rosette strains (extensometer measurements on three gage lines 45 deg. apart). Fig. 7 shows the results by direction of stress and stress contours under a load of 5,000 lb., about one-third of the breaking load. The highest measured stress was about 10 per cent higher than that given by Westergaard's formula.—PROF. M. G. SPANGLER *and* LIGHTBURN, *Iowa State College, Ames.*

Bond Strength of Steel—Pullout and beam tests of steel bars from ⅜ to ¾ in. diameter, both plain and deformed, showed the ratio of bond stress to ultimate compressive strength to be lower for stronger concrete. At first slip the ratio was about 0.16 for 3,000 lb. concrete and 0.12 for 5,000 lb. concrete in pullout test, and 0.12 and 0.10 in beam test. The ultimate load of plain bars was little above the load at first slip, while deformed bars carried additional load, up to the point of split-

ting the concrete. Additional length above a ratio of length to diameter of 24 did increase the strength. In the beams, first cracking appeared at one-third to one-half the load at first slip.—H. J. GILKEY, S. J. CHAMBERLIN, and R. W. BEAL, *Iowa State College, Ames.*

Expansion Joint Dowels—Tests of pavement expansion joints with both solid and hollow dowels under shear and bending loads showed higher strength for hollow dowels, apparently because of their larger bearing area.—PROF. INGE LYSE, *Lehigh University, Bethlehem, Pa.*

Concrete Vibration — Experience during the past two years in several states demonstrates that vibration of paving concrete is beneficial, permits denser and drier concrete to be placed, and economizes in cement.

Illinois in its early field experiments with vibration some years ago found that some scaling followed, but without proof that the vibration was the cause. Its recent construction shows no scaling after a year. Vibrated 1-in-slump concrete showed much less honeycomb than 2-in-slump concrete placed by standard methods. Kansas reports a saving of 10 per cent cement by vibration, but states that concrete made with chatts can not be vibrated. Reduction in cement was also obtained in Iowa, together with a reduction of labor cost in the placing crew; strength and density were almost identical for standard and vibrated concrete. Wisconsin reported a definite gain in strength on a 9-mile section.—COMMITTEE REPORT.

Brick pavement

Pavement Joint Fillers—Various joint fillers were tried in a brick test road near Columbus, Ohio, built in 1935. After two years only two fillers, both blended asphalt, were reported to be in excellent condition. Other fillers exuded or flowed to the low sides of the pavement. Some caused the brick to loosen.—PROF. J. S. CRANDELL, *University of Illinois, Urbana.*

Position of Brick—In a test section of brick road in Ohio, recently built, the brick were laid longitudinally. Much less breakage of the brick during rolling and under traffic is reported and the pavement is noticeably more quiet.—PROF. J. S. CRANDELL, *University of Illinois, Urbana.*

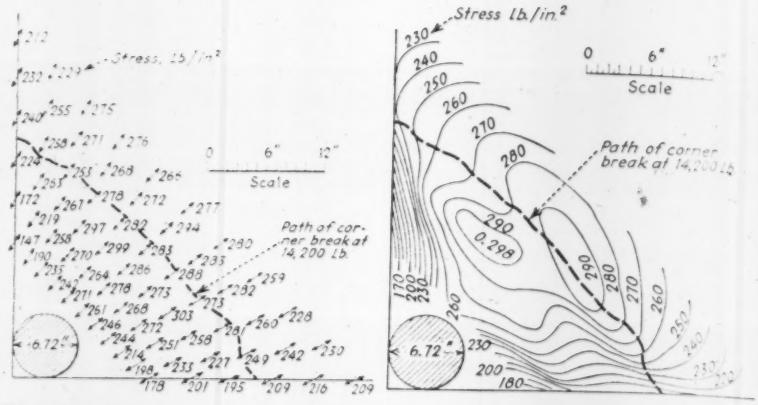

Fig. 7. MEASURED PRINCIPAL STRESSES near corner of 6-in. concrete slab on clay subgrade under 5000-lb. corner load.

Filler Affected by Base Joints—Exudation of certain fillers in a test road was greatest over the contraction joints in the base, probably due to kneading of the asphalt. A section of brick laid on plain sand cushion showed heavy filler exudation, while an adjoining section laid on mastic cushion showed less exudation except over the base contraction joint.—H. Z. SCHOFIELD, *National Paving Brick Association, Washington.*

Bituminous roads and asphalts

Flexible Pavement Design—While subgrades for flexible pavement can be prepared to provide a reasonably uniform and constant support for road surfaces, knowledge of bearing capacity for use in design is lacking. The pressure transmitted to subgrades by flexible pavements may depend on the rigidity of the surface as well as upon the surface. More comprehensive test data on load-supporting capacity and pressure distribution of flexible pavement are needed, as well as more information on loads, particularly their dynamic effect.—A. C. BENKELMAN, *Bureau of Public Roads, Washington.*

Properties of Asphalts—To obtain data for a specification for asphalts, 23 oil asphalts of 85 to 100 penetration were investigated for physical properties.

Abrasion, impact and ductility tests gave roughly the same order of quality, as determined by loss through weathering (22 hr. exposure to ultra violet light). Asphalts that gave a positive spot test generally showed low weathering resistance. It was found that a composite of the impact, abrasion and ductility resistance was a rough indication of the rating of an asphalt and correlated quite well with the quotient of flash point divided by the viscosity index between 33 and 77 deg. F. The best asphalts tended to have high molecular weight.—F. C. LANG, *Minnesota Highway Department, Minneapolis.*

Coagulation of Asphalts—Microscopic study of asphalt films 1/1000th inch thick either in the natural condition or after exposure to heat, air, sunlight or ultraviolet light showed that rapid coagulation occurs in some asphalts, which appears to be a separation of the material into a hard and a more liquid phase. The coagulation may result from heat in the absence of light or air, or by exposure to sunlight. It is accelerated by contact with air and oxygen and retarded by carbon dioxide; ultraviolet radiations also accelerate it. The coagulation occurs more frequently in positive Oliensis materials than in negative.—J. R. BENSON and C. J. BECKER, *Kansas Highway Commission, Manhattan.*

Road maintenance costs

Maintenance Costs Erratic—Collection of data on maintenance costs from different states has produced no consistent or conclusive figures. The variations bear no relation to traffic. Betterments are sometimes included, and in other cases not all costs are included. Often the maintenance cost appears to be merely a measure of the amount spent.—H. K. BISHOP, *Bureau of Public Roads, Washington.*

THE WEEK'S EVENTS

(Continued from page 969)

Standardization Progress In Past Year

Fifty-nine standards have been approved during the past year by the American Standards Association, Dana D. Barnum, president of the Association, announced at the annual meeting held in New York City Dec. 1. Outstanding among these is the standard for railway grade crossing protection, developed by the Association of American Railroads. This brings to five the important standards in the field of traffic safety approved by the Association. The new standards approved this year bring the total number approved since the association was organized in 1918, to 382.

In connection with new work undertaken this year, Mr. Barnum spoke particularly of developments in the building code field. Three new building projects have been authorized during the year—administrative requirements for building codes, requirements for excavation and foundation, and requirements for iron and steel. By removing unduly restrictive regulations and opening the way for the use of new materials and new methods, Mr. Barnum feels that the association can do much to aid in the solution of the current housing problem.

All present officers were re-elected for the year 1938 except that R. P. Anderson, secretary of the Division of Refining, American Petroleum Institute, has been elected vice-chairman of the Standards Council.

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Niagara River Fish Die As Pollution Increases

An unexplained increase in industrial pollution in the Niagara River at Buffalo, N. Y. is held responsibile for the death of thousands of fish since the middle of November. The preliminary reports on investigations now under way indicate the poisoning arose from cyanide, rather than from oxygen deficiency.

Little danger of contamination of the Buffalo water supply is anticipated unless there is a greater concentration of toxic substances than has yet been found, according to city chemist Dr. E. J. Powers. The Buffalo supply comes from a point in Lake Erie some distance from the river.

First evidence of the slaughter of game fish and minnows appeared Nov. 14 when the banks of the river were found to be covered with a mile-long blanket of dead fish. The fish washed ashore, about 600 tons, were believed to be only about half the number killed.

Studies point to the Buffalo River, which empties into the Niagara, as the source of pollution. Eighty-five per cent of the wastes entering this stream come from industrial concerns discharging process water containing acid, phenols, cyanide, and other organic compounds.

A combination of climatic conditions —rainfall plus strong on-shore winds which piled up lake water in the river —has been suggested as the reason for the sudden toxicity of the water. Under normal low-flow conditions existing in the Buffalo river, toxic substances are decomposed before entering the Niagara. A sudden flushing effect, however, such as occurred when the wind changed and released impounded water, would discharge these substances in a more concentrated state, it was explained by Dr. G. E. Symons, chief chemist of the Buffalo Sewer Authority.

Rehabilitation Proposed For New York Beaches

A plan for the rehabilitation of Coney Island, Far Rockaway Park, and South Beach, Staten Island, has been proposed by New York City Park Commissioner Moses to the Mayor. The cost of the proposed plan would be about $16,150,000. These parks, which have been under the control of the borough administrations, will come under the City Park Department Jan. 1 when the new city charter goes into effect.

Coney Island would be completely changed from its traditional form under the plan. Commissioner Moses recommends elimination of side shows and mechanical amusements and would place emphasis instead on larger beach areas, play areas, recreational spaces, bath houses and parking spaces. Under the plan, the present boardwalk would be moved back about 300 ft., doubling the beach area, and a depth of 100 ft. on the shore side would be reserved for park and playground purposes.

Similar changes would be made at Rockaway Beach, and in addition the lines of the Long Island R.R. through the Rockaways would be elevated to eliminate grade crossings. Mr. Moses proposes an amendment to the state constitution which would permit the state to provide all of the funds.

EASIER TO UNDERSTAND

VISITORS to Grand Coulee dam in the Columbia River are aided to visualize and understand the features of the huge structure by means of this model 1/600 of the size of the dam itself.

At the right is the west end of the base of the dam, completed before Jan. 1, 1937, and at the left are the cross-river cofferdams which forced the river out of its natural channel and through low gaps left in the west end of the base.

Above and back of the west end of the dam is an excavation for the pumping plant which will lift water from the storage reservoir behind the dam to a balancing reservoir in the Coulee itself.

Legislature May Change Engineer's Salary

Holding that a county engineer is not employed under contract but is an appointed public official, the Kentucky Supreme Court ruled recently that the state legislature may properly change the salary during his incumbency.

The case arose when the county engineer of Ottawa county brought suit to recover a balance of $500 claimed unpaid on his salary. He claimed that his salary under contract was $200 per month for one year. The county stated the legislature had reduced the $200 to $150 per month in 1933 and that the reduction became effective two months after the year began in which the engineer was employed.

The court held that the employment of the county engineer was not a contract but an appointment of a county official, because the office of county engineer was created and its duties defined by the legislature. Therefore, a subsequent legislature may repeal or modify the former act or change the compensation allowed without impairing the obligation of a contract. An appointment or election to a public office, the court held, does not establish a contract relation between the person elected and the public.

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To Hold Surveyors Institute At North Carolina

A three-day Institute for Surveyors is to be held at the engineering college of the University of North Carolina Jan. 24-26, 1938. The attendants will receive regular classroom and field instruction in various surveying subjects, ranging from adjustment of instruments and determination of true north to discussion of legal questions with which the surveyor deals.

A series of evening lectures by Prof. Dugald C. Jackson, former professor of electrical engineering at Massachusetts Institute of Technology, will be given on the evenings of the three days. The subjects of the lectures are: Civilization and Engineering at the Dawn of History, Unfolding of Community Life and Commerce Under the Influence of Engineering, and Influence on Civilization of Further Widening of Engineering.

Lodging and subsistence accommodations will be available at or near the college. Those desiring to attend should send in applications to the extension division of North Carolina State College, Raleigh, with registration fee of $5.

On the day following the close of the surveyors institute, a one-day Institute for Engineers will be conducted. Subjects of scheduled lectures are: The Status of Engineering in North Carolina, Structural and Technical Glass, The Chemistry of Metals and Alloys, Recent Developments in Physics as Related to Engineering, Air Conditioning, North Carolina's Mineral Resources and Geological Engineering, and The Inseparability of Engineering and Civilization.

The North Carolina Society of Engineers will hold its mid-winter convention at the Carolina Hotel during the two days following the Engineers Institute. Sessions of the state sections of engineering societies are scheduled in connection with the convention.

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Post Resigns as Head Of Housing Body

Langdon W. Post has resigned his position as chairman of the New York City Housing Authority, and his resignation has been accepted by Mayor LaGuardia. In his letter of resignation, Mr. Post attacks the Mayor for his "intention to dominate and control the policies and acts of the New York City Housing Authority."

The dispute between Mr. Post and Mr. LaGuardia came into the open in connection with a conference held by Nathan Straus, chairman of the U. S. Housing Authority. At that time, Mr. LaGuardia attacked Mr. Straus for holding conferences instead of immediately acting on housing applications and refused to allow any member of the New York City authority to attend the conference. Charles Abrams, counsel to the authority, resigned in order to attend the meeting in the capacity of counsel to the American Federation of Housing Authorities.

The New York City Authority has now lost four of its six members. Mr. Straus, formerly a member, resigned to take his federal position and Mr. Vladeck, recently elected to the city council, will leave the authority Jan. 1.

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Texas Bars Non-Residents On Highway Contracts

The Texas Highway Commission has adopted a plan intended to give Texas contractors preference on Texas highway work. A resolution was adopted providing that non-resident contractors may not bid on state jobs, except federal aid work, until one year after they have done road work in Texas.

Regulations of the Bureau of Public Roads prohibit such restrictions on federal aid road work, so that the Texas plan thus requires that before a non-resident can do any state work, he must have had a federal aid job at least a year before bidding.

Highway Buried by Slide To Be Rerouted

Immediate construction of a temporary rerouting for the portion of Riverside Drive in Los Angeles which was blocked by the Elysian Park landslide Nov. 26 (*ENR*, Dec. 2, 1937, p. 881) was voted by the Los Angeles city council, which set aside $25,000 for the purpose. The action was taken after John P. Buwalda, consultant for the park department, had reported that it would take years for the slide area to settle down. Use of the funds requires approval of the state highway commission.

The temporary roadway around the slide area would provide a 40-ft. road over an earth fill and a timber driveway. Riverside Drive normally carries a large volume of traffic, now forced to make long detours.

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L. W. Wallace Joins Crane

Lawrence W. Wallace, director of equipment research for the Association of American Railroads since 1935, has been appointed director of Engineering and research for Crane Co., Chicago. Mr. Wallace served as executive secretary of the American Engineering Council from 1921 to 1934. Before going to the Association of American Railroads to head its enlarged research program, he was with the W. S. Lee Engineering Corp. as vice president.

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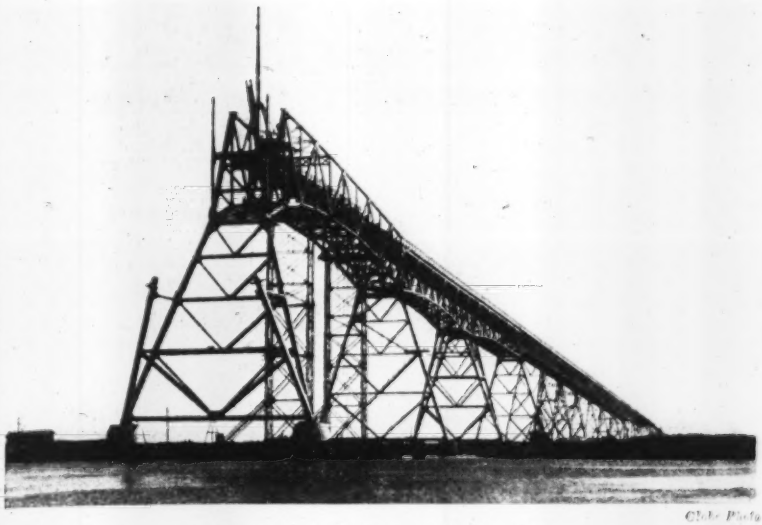
Pennsylvania Takes Action Against Pollution

Taking its first major step in the program of stream pollution control set up by the LaRue bill passed by the 1937 session of the state legislature (*ENR*, July 8, 1937, p. 47), the Sanitary Water Board of the Pennsylvania Department of Health has ordered the city of Altoona to submit plans for modernization of its sewage disposal plants by May 1. Altoona discharges the effluent of its sewage plant into the Juniata River, which flows into the Susquehanna. The board plans to clean up the tributary streams before attacking the main rivers flowing through Pennsylvania.

It is expected that similar action will be taken against Hollidaysburg and Tyrone, also on the Janiata, as well as against the Viscose Co. at Lewiston.

The Sanitary Water Board is granted broad powers under the LaRue bill. It may order any person or municipality now discharging sewage into rivers to stop doing so at any time, without regard to any previous permit, and fines may be imposed for failure to obey



TALL AS A TWENTY-STORY BUILDING

THE APPROACH to the $2,750,000 Port Arthur bridge across the Neches River in southeast Texas reaches a long way toward the sky as it comes to the River's edge. The mile and a half long bridge rises from flat marshland to attain an extreme height of 230 ft., about that of a 20-story building. The main span across the river will provide a horizontal clearance of 600 ft. and a vertical clearance of 176 ft.

The structure, which will shorten the travel distance between New Orleans and Texas and Gulf coastal points, is being built by the Texas Highway Commission and Jefferson County with PWA assistance. It was begun in February, 1936, and will be completed in March of next year.

Unusual foundation problems met in construction of this bridge were described in an article in the issue of *Engineering News-Record* for Sept. 9, 1937, p. 421.

Bluestone Land Case Dropped by Government

Acting at the request of federal attorneys, the Federal Court at Huntington, W. Va., has dismissed the government's condemnation suit seeking land for the site of the proposed $13,000,000 Bluestone flood control dam on the New River. The action was dropped, it was stated by Department of Justice officials, at the request of the War Department because the allotment for preliminary work, allotted from 1935 relief funds, had expired.

The suit was dismissed over protests of attorneys for the West Virginia Power Co. which has requested the U. S. Supreme Court to review a circuit court order upholding the government's right to condemn the land (*ENR*, Nov. 11, 1937, p. 772).

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Bidders' Names Announced On Texas Highway Jobs

Names of prospective bidders on Texas highway projects will be made public in the future, it has been announced. This reverses a previous policy of not revealing the names.

State highway engineer Montgomery said that much difficulty has been caused material dealers and others in the past. He believes that better bids can be secured and a saving effected under the new plan, since all material dealers will have time to make competitive quotations to all bidders.

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Platte Valley Engineer Resigns from Project

Donald D. Price, general manager and chief engineer of the Platte Valley Public Power and Irrigation District, North Platte, Neb., and Eugene Halmos, resident engineer for the consulting engineers on the project, have resigned. Mr. Price is to be succeeded temporarily as general manager by Gerold Gentleman, secretary of the district.

The district has been engaged for the past three years in building the Sutherland project, a scheme for storing irrigation water and using it for the development of power. The work is nearing completion after a number of delays due to unforeseen developments, including a serious break in the siphon under the South Platte River. The future of the project has been the subject of controversy for some time.

City Held Not Liable For Sales Tax

The city of St. Louis was held not to be liable for the state sales tax on materials used by contractors in the construction of sewers, street paving, and hospitals in a decision handed down Dec. 2 by the Missouri Supreme Court. The Supreme Court decision reversed a previous ruling of the Cole County Circuit Court. The court asserted that "the sale of materials by dealers to the contractors was the taxable transaction."

A lump sum to be paid by the city had been fixed in the contract with the construction firm. The opinion held that the contractors "used and consumed the materials in order to produce a finished product in compliance with their contract" and that the city could not be considered the user of the materials.

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Oregon Water Planners Make First Report

To provide basic hydrologic data, on which to base the economic control and use of the waters of the state of Oregon, will require 75 additional precipitation stations, 12 snow survey courses, 136 stream gaging stations, 8 evaporation stations and 320 ground water explorations, all in addition to those now existing in the state, according to a report of the State Planning Board's Advisory Committee on Water Resources. This is the first report of this committee, of which G. H. Canfield, district engineer of the U. S. Geological Survey, Portland, is chairman. The committee consists of 11 men from federal departments and bureaus including the Army Engineers, Bureau of Agricultural Engineering, U.S.G.S., Bureau of Reclamation and Weather Bureau, as well as consulting civil engineers and representatives from state departments.

The additional observation stations listed above are estimated to cost $251,610 to install and will have an annual operating cost of $71,750. In addition to the basic hydrologic data to be secured from these stations, the report lists a number of supplementary studies that would be needed to produce a comprehensive set of facts from which to plan an economic use of the state's water resources. These include studies and surveys of silting erosion, sanitation, effects of forest cover on stream flow, land classification, fish conservation, and river utilization. The cost of these studies, which would be spread over a period of years, is estimated at more than $1,000,000.

OBITUARY

WATSON G. CLARK, assistant state director for New Jersey of the Coast and Geodetic Survey and formerly state highway engineer of New Jersey, died Dec. 7, at the age of 66 in Tenafly, N. J. Mr. Clark, a graduate in 1891 of New York University, had served as municipal engineer for towns in Bergen County and had been engineer for the Tenafly sewer system.

HENRY A. HARRIS, a construction engineer who had recently been supervisor of operations for the WPA in Hudson County, N. J., died Dec. 2, in Jersey City, at the age of 55. Mr. Harris was for many years connected with the George A. Fuller Co. of New York City, had been president of his own firm, and had been associated with Voorhees, Gmelin & Walker, also of New York City. He was superintendent during the construction of Knickerbocker Village, and at the beginning of the century he was on the staff of the Jersey City engineer office.

HOWARD L. BECK, who retired about five years ago as city architect of Buffalo, N. Y., died in that city Nov. 25 at the age of 64.

JOHN KRIPPNER, a structural engineer with the Chicago firm of Shaw, Nuess & Murphy, died Nov. 29, at the age of 59. While practicing as a consulting engineer and while with Graham, Anderson, Probst & White, he designed many of the large buildings in Chicago.

JOHN A. BAUMANN, resident engineer inspector for PWA in Rock Island, Ill., died there Dec. 1, at the age of 65.

GILES H. TUNURE, deputy commissioner of public works of White Plains, N. Y., died at a hunting club near Kopake, N. Y., Dec. 2, at the age of 46. Mr. Tunure had been in the employ of the city for 25 years.

JOHN M. HEISKELL, 84, who practiced until a few years ago in Memphis, Tenn., died in Nashville, Nov. 29. A graduate of Stevens Institute, Mr. Heiskell was an engineer on the construction of the Frisco Bridge at Memphis, and was later on the engineering staff of the Michigan Ry.

GEORGE L. VAN HAGEN, connected for several years with the New York State highway department, died Nov. 29 in Beacon, N. Y., at the age of 55.

L. A. WESTON, inventor and manufacturer of a gasket for sewer pipe joints, died in Adams, Mass., Nov. 13, at the age of 77.

CHARLES S. STEGALL, 71, a retired civil engineer, died at San Diego, Cal., Nov. 15.

WILSON F. SMITH, New York City civil engineer, who was chief engineer in charge of construction of the Kensico Dam for the City of New York and of the Bear Mountain Bridge on the Hudson River, died in New York at the age of 66. Mr. Smith graduated from the Columbia School of Mines in 1894 and after brief connection with a number of railroad and engineering firms, he became assistant engineer for the New York Rapid Transit R. R. Commission, in charge of tunnel work. After six years he became division engineer for the New York City Board of Water Supply in charge of the Kensico division. During the war, Mr. Smith was connected with the emergency fleet corporation and later was with Deering, Milliken, Inc.

GEORGE Y. SKEELS, 72, formerly city engineer of Sioux City, Ia., and more recently in consulting practice there, died in Waco, Tex., Nov. 20.

ROBERT A. CAIRNS, for 46 years city engineer of Waterbury, Conn., died Nov. 22 at the age of 78. Outstanding among his accomplishments in that period was the construction of the Shepaug reservoir and tunnel system. Mr. Cairns, a graduate of Rensselaer Polytechnic Institute, was a past-president of the Connecticut Society of Civil Engineers.

DAVID A. HEFFERNAN for 45 years superintendent of the Milton, Mass., water works and a past-president of the New England Water Works Assn., died in that town Nov. 24 at the age of 78. Mr. Heffernan was the holder of the Dexter Brackett award which had been given him by the New England Water Works Association.

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Thoron Resigns from PWA

D. W. Thoron recently resigned his position as director of the PWA finance division; he will become chief of the bond service section of the self-liquidating division of the Reconstruction Finance Corp., which has been acting as agent for PWA on the sale of bonds accepted as security for public works loans.

Mr. Thoron became director of the PWA financial division in December, 1935. He graduated from Harvard University in 1919 and Massachusetts Institute of Technology in 1922. Before entering government service he had private experience as a civil engineer and had also been an investment banker.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Netherland-Plaza Hotel, Cincinnati, Jan. 12-14.

AMERICAN ENGINEERING COUNCIL, annual convention, Washington, D. C., Mayflower Hotel, Jan. 13-15.

SECRETARIES OF ENGINEERING ORGANIZATIONS, annual conference, Washington, D. C., Mayflower Hotel, Jan. 13-15.

AMERICAN ROAD BUILDERS ASSOCIATION, road show and convention, Cleveland, Jan. 17-21.

AMERICAN WOOD PRESERVERS ASSOCIATION, annual meeting, Chicago, Congress Hotel, Jan. 18-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York City, Jan. 19-21.

ENGINEERING INSTITUTE OF CANADA, annual meeting, London, Ont., Jan. 31-Feb. 1.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, annual meeting, Engineering Societies Building, New York City, Feb. 14-18.

REGIONAL AND LOCAL

LOUISIANA ENGINEERING SOCIETY, annual meeting, St. Charles Hotel, New Orleans, Jan. 7-8.

UNIVERSITY OF COLORADO, Highway Engineering Conference, Boulder, Colo., Jan. 13-14.

NEW JERSEY ASSOCIATION OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS, Elks Club, Jersey City, N. J., Jan. 14-15.

NEW YORK STATE SEWAGE WORKS ASSOCIATION, annual meeting, New York City, Jan. 20-22.

NORTH CAROLINA SOCIETY OF ENGINEERS, annual meeting, Raleigh, Jan. 28-29.

SOUTHWEST ROAD SHOW AND SCHOOL, annual session, Wichita Exhibition Building, Wichita, Kan., Feb. 22-25.

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License Examinations

NEW YORK: Examinations for professional engineers at New York, Albany, Syracuse and Buffalo, Feb. 1-3. Examinations for land surveying, Feb. 4.

MICHIGAN: Examinations for civil engineers and surveyors at the University of Detroit, Michigan State College, the Michigan College of Mining and Technology, and at Ironwood, Dec. 29-31.